# CURRICULUM VITAE
# AND
# EPITOME OF PUBLISHED WORK

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School of Electrical & Computer Engineering
Faculty of Engineering
Aristotle University of Thessaloniki

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## 1. Personal details


| | |
|---|---|
| Father's name: | Nikolaos |
| Date of Birth: | 14 March 1967 |
| Place of Birth: | Kavala, Greece |
| Marital Status: | Married, two children |
| Home Address: | Makryrachis 8, Thessaloniki GR-551 33 |
| Position: | Associate Professor in High Voltage Engineering |
| Work Address: | Aristotle University of Thessaloniki, Faculty of Engineering,<br>School of Electrical & Computer Engineering<br>Department of Electrical Energy<br>High Voltage Laboratory<br>Building D, Egnatia Str., Thessaloniki GR-541 24<br>Tel../Fax: 2310 995860, e-mail: pnm@eng.auth.gr, url: http://www.eng.auth.gr/hvl |


## 2. Education

| | |
|---|---|
| July 1995 | PhD Degree in Electrical and Computer Engineering, School of Electrical & Computer Engineering, Faculty of Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece; Supervisor: Prof. C.A. Stassinopoulos. |
| September 1991 | Diploma Degree in Electrical Engineering, Department of Electrical Engineering, Faculty of Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece. |

## 3. Teaching activity

02/2003 – today
Aristotle University of Thessaloniki

- **Undergraduate courses**
  School of Electrical & Computer Engineering, Faculty of Engineering
  - High Voltage Engineering I; 6th semester, compulsory
  - High Voltage Engineering II; 7th semester, compulsory
  - High Voltage Engineering III; 8th semester, elective
  - High Voltage Engineering IV; 9th semester, elective.
- **Laboratories**
  School of Electrical & Computer Engineering, Faculty of Engineering
  - High Voltage Engineering 1; compulsory, five (5) laboratory exercises in generation and measurements of high voltages
  - High Voltage Engineering 2; compulsory, four (4) laboratory exercises in the broad field of high voltage applications.
- **Supervision of Diploma Theses (5th year project)**
  School of Electrical & Computer Engineering, Faculty of Engineering
  - One hundred and thirteen (113) have been completed, five (5) in progress
- **Lecture Notes**
  - P.N. Mikropoulos, "*Laboratory exercises in High Voltage Technology*", for the courses: High Voltage Engineering I and II, pages 178
  - P.N. Mikropoulos, "*Exercises in High Voltage Technology*", for the courses: High Voltage Engineering I and II, pages 79
  - P.N. Mikropoulos, "*Introduction to HVDC Transmission Systems*", for the course: High Voltage Engineering II, pages 18
  - P.N. Mikropoulos, "*Lightning Protection Systems*", for the course: High Voltage Engineering III, pages 81

02/2003 - today
Aristotle University of Thessaloniki

- **Postgraduate courses**
  School of Electrical & Computer Engineering, Faculty of Engineering
  - Advanced Theory of Electrical Breakdown
  - Advanced High Voltage Measurement Techniques

10/1999 - 01/2003
Technological Educational Institute of Crete

- **Undergraduate courses**
  Assistant Professor with the Department of Electrical Engineering, School of Applied Technology
  - High Voltage Technology and Laboratory
  - Electrical Installations I and II
  - Supervision of Graduation Theses

06/1997 - 09/1999
UMIST (The University of Manchester)

Teaching assistant for both undergraduate and postgraduate High Voltage Laboratory courses, Assistant Supervisor for MSc and PhD theses, Electrical Energy and Power Systems Group, Department of Electrical Engineering and Electronics, UMIST.

09/1991 - 05/1997
Aristotle University of Thessaloniki

Teaching assistant for the undergraduate courses High Voltage Engineering I, II and III, School of Electrical and Computer Engineering, Faculty of Engineering.

## 4. Research activity

02/2003 – today
Aristotle University of Thessaloniki

Assistant Professor (1/2003-4/2010), Associate Professor (4/2010 - today)
High Voltage Laboratory, Department of Electrical Energy, School of Electrical & Computer Engineering, Faculty of Engineering.

**Research areas**

- Dielectric strength of external insulation
- Surface dielectric strength of insulating materials
- Lightning protection and Earthing
- Insulation coordination for power systems
- Electrostatic field analysis
- High voltage and high current measurement devices and techniques

**PhD Theses**

- **Supervision**
  - Nikolaos Mavrikakis, “Ageing mechanisms of outdoor insulators”, 2/2014 -
  - Zacharias Datsios, “Soil ionization phenomenon in concentrated grounding systems”, 10/2010 -
  - Vasileios Zagkanas, “Corona phenomenon on overhead transmission lines”, 9/2008 – 8/2014
  - Lazaros Tzimkas, “Surface dielectric strength of insulating materials in a uniform electric field”, 12/2007 -
  - Thomas Tsovilis, “A statistical lightning attachment model: Lightning incidence estimation and shielding design”, 12/2005 - 10/2010
  - Lazaros Lazaridis, “Surface dielectric strength of insulating materials in a non-uniform electric field under impulse voltages: Influence of humidity”, 12/2004 - 6/2010
- **Advisory Committee Member**
  - Christakis Gazelis, “Experimental study of atmospheric-pressure cold micro-plasmas produced by high voltages of different waveform”, High Voltage Laboratory/University of Patras & Université de Pau et des Pays de l’Adour, Supervisor: Asst. Professor P. Svarnas, 2011 -

- Alrim Viviane, “Computational methods for electromagnetic coupling and radiation effects on transmission lines”, Telecommunications Laboratory/AUTh, Supervisor: Professor C. Antonopoulos, 11/2010 -
- Andreas Chrysochos, “Modelling of the transient behaviour of power cables in the frequency domain”, Power Systems Laboratory/AUTh, Supervisor: Assoc. Professor G. Papagiannis, 10/2010 -
- Petros Mavroidis, “The effect of dielectric covers on impulse behaviour of non-uniform gaps”, High Voltage Laboratory/AUTh, Supervisor: Professor C.A. Stassinopoulos, 10/2002 - 11/2010
- Charalambos Yakinthos, “Experimental results for increasing the dielectric strength in non-homogenous gaps: gap compaction in high voltage power lines”, High Voltage Laboratory/AUTh, Supervisor: Professor C.A. Stassinopoulos, 10/1995 - 2/2010

- **Examination Committee Member**
  - Christos Kaloudas, “Dynamic model of constant parameter transmission line with the finite difference time domain method”, Power Systems Laboratory/AUTh, 2013
  - Despoina Pitsa, “Modelling of breakdown phenomena in nano-composites materials”, Power Systems Laboratory/Democritus University of Thrace, 2013
  - Dionisios Pylarinos, “Investigation of the behaviour of high voltage insulators using leakage current measurements”, High Voltage Laboratory/University of Patras, 2012
  - Fani Asimakopoulou, “Contribution to the investigation of soil ionization”, High Voltage Laboratory/NTUA, 2011
  - Pavlos Katsivelis, “Contribution to the investigation of electrostatic discharges”, High Voltage Laboratory/NTUA, 2011
  - Angelos Bouchouras, “Power distribution network reconfigurations for loss reduction and reliability improvement under real operating conditions”, Power Systems Laboratory/AUTh, 2010
  - Theofilos Papadopoulos, “Influence of earth on the propagation characteristics of transmission lines”, Power Systems Laboratory/AUTh, 2008
  - Lymperis Papageorgiou, “Theoretical study of the ionization waves that are produced and propagate at cold plasmas gas discharges”, Electrotechnic materials Laboratory/University of Patras, 2007
  - Kyriakos Siderakis, “Investigation of the behaviour of porcelain and RTV SIR coated porcelain insulators in field and laboratory conditions through leakage current measurements”, High Voltage Laboratory/University of Patras, 2006

**Examination Committee Member for MSc Dissertations**

- Ioannis Baroutis, ““Behaviour of water droplets under the influence of uniform electric field in samples of borosilicate glass”, Power Systems Laboratory/Democritus University of Thrace, 2013
- Constantina Varsamidou, “Behaviour of water droplets under the influence of uniform electric field in nanocomposite samples of Epoxy resin/$TiO_2$”, Power Systems Laboratory/Democritus University of Thrace, 2013
- Aggeliki Bairaktari, “Behaviour of water droplets under the influence of uniform electric field in nanocomposite samples”, Power Systems Laboratory/Democritus University of Thrace, 2012
- Despoina Christantoni, “Breakdown phenomena in nanocomposite materials: Surface discharges”, Power Systems Laboratory/Democritus University of Thrace, 2011

01/2000 - 02/2001
Aristotle University of Thessaloniki

Postdoctoral research, Scholarship from the Greek State Scholarships Foundation
**Research Institute**
High Voltage Laboratory, School of Electrical and Computer Engineering
**Research subject**
Surface dielectric strength of insulating materials in air, influence of atmospheric conditions.

06/1997 - 09/1999
UMIST

Postdoctoral research (Research Associate, EPSRC Grant)
**Research Institute**
High Voltage Laboratory, Electrical Energy and Power Systems Group, Department of Electrical Engineering and Electronics.
**Research subject**
Surface dielectric strength of insulating materials in gases.

04/1990 - 05/1997
Aristotle University of Thessaloniki

Diploma Thesis (04/90 - 05/91), PhD Thesis (11/91 - 07/95), Postdoctoral research (07/95 - 05/97).
**Research Institute**
High Voltage Laboratory, School of Electrical and Computer Engineering
**Research subject**
Air breakdown mechanism, influence of atmospheric conditions.

## 5. Educational and Research projects

02/2003 – today
Aristotle University of Thessaloniki

**Coordinator and Principal investigator**

- "Student internship: School of Electrical & Computer Engineering, AUTh", Operational Programme for Education and Initial Vocational Training (EPEAEK II), Hellenic Ministry of National Education and Religious Affairs, 1/2006-9/2008
- "Electrical engineering studies for the Ag. Nikolaos power plant 430 MW", RODAX Corporation, 1/2008-1/2009
- "Insulation coordination study for the High Voltage substation of Aluminium de Grèce S.A.I.C.", Aluminium de Grèce S.A.I.C., 6/2008-6/2009
- "Electrical engineering studies for the 400kV/150kV GIS substation at Aliveri", METKA S.A., 8/2008-8/2009
- "Evaluation of fast-front overvoltages arising at a 20/0.4 kV distribution transformer due to lightning surges", RAYCAP Corporation, 10/2009-12/2009
- "Insulation coordination study for the 150 kV GIS substation and the power plant at Korinthos", RODAX Corporation, 2/2010-2/2011
- "Insulation coordination study for the Ilarion power plant", RODAX Corporation, 5/2009-11/2011
- "Corona phenomenon on overhead transmission lines", Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) – Research Funding Program: HERACLEITUS II, co-financed by the European Union (ESF) and Greek national funds, 9/2010-8/2014, supports the PhD Thesis of V. N. Zagkanas
- "Protection of distribution transformers against overvoltages due to direct lightning strokes to overhead medium-voltage distribution lines", RAYCAP Corporation, 1/2013-3/2013
- "Evaluation of causes of Axiochori PV plant outage and possible remedy measures", Enexon Hellas S.A., 4/2013-5/2013
- "Insulation coordination study for the 400 kV and 132 kV GIS substations and the power plant «Shat-Al-Basra 10xGT9E OCPP 1250MW»", METKA S.A., 10/2012-10/2013
- "Research in energy issues and their environmental impact", Research project of the Department of Electrical Energy, 6/2010-5/2016

**Participation**

- "Insulation coordination study for the single shaft combined cycle power plant at Lavrion", RODAX Corporation, Coordinator: Prof. P. Dokopoulos, 10/2004-12/2004
- "Withstand capability of surge protective device for telecommunication lines on impulse currents", EMIL KIPRIOTIS S.A., Coordinator: Prof. P. Dokopoulos, 12/2005 - 9/2006
- "Type tests on medium voltage switchgear", IONIOS S.A., Coordinator: Prof. C. A. Stassinopoulos, 10/2003
- "Strengthening informatics at the School of Electrical and Computer Engineering of AUTh", Operational Programme for Education and Initial Vocational Training (EPEAEK II), Hellenic Ministry of National Education and Religious Affairs, 2003-2007, Coordinator: Prof. P. Mitkas.
- "Electrical engineering studies for the Aliveri power plant 416.95 MW", RODAX Corporation, Coordinator: Asst. Prof. G. Papagiannis, 2/2008-7/2008
- "Fault current distribution along overhead transmission lines and specifications of insulator strength", Public Power Corporation SA, Coordinator: Prof. P. Dokopoulos, 5/2008-9/2008
- "Student internship: School of Electrical & Computer Engineering, AUTh", National Strategic Reference Framework (NSRF) 2010-2013, Coordinator: Lecturer M. Alexiadis, 9/2010-8/2013

11/2000 - 01/2003
Technological Educational Institute of Crete

**Coordinator**
"Internship of students of the Department of Electrical Engineering, School of Applied Technology", Operational Programme for Education and Initial Vocational Training (EPEAEK II), Hellenic Ministry of National Education and Religious Affairs.

06/1997 - 09/1999
UMIST

**Research Associate**
"Surface dielectric strength of insulating materials in gases", EPSRC Grant, Coordinator: Dr N.L. Allen (Visiting Professor)

## 6. Administrative activity

02/2003 – today
Aristotle University of Thessaloniki

- Vice-Chairman of the School of Electrical and Computer Engineering (ECE), Faculty of Engineering, AUTh (2011/2013)
- Head of the Department of Electrical Energy/ECE (2010/2011, 2013/2014)
- Director of the High Voltage Laboratory (09/2005 - today)
- Other Positions and Representations
  - Tender Committees/AUTh
  - Representative of the Environment Council of AUTh for the installation of the High Voltage Substation (400 kV) of Lagada/AUTh (2007)
  - Special Interdepartmental Committee for the Postgraduate Studies Programme "Protection, Conservation and Restoration of Architectural Monuments"/Faculty of Engineering (2007/2008 - 2012/2013)
  - Student Internship Committee/Faculty of Engineering (2009/2010)
  - Working Group on the Spatial Development of the Faculty of Engineering/ECE (2009)
  - Curriculum Committee/ECE (2009 - today)
  - Internal Evaluation Group/ECE (2010 - today)
  - Student Internship & Vocational Guidance Committee/ECE (2005/2006, 2008/2010)

- Student Affairs Committee/ECE (2009/2010)
- Responsible for the Schedule of Classes/ECE (2008/2010)
- European Educational Programs Committee/ECE (2003/2005)
- Student Advisory Committee/ECE (2003/2005)
- Tender Committees/ECE

06/2001 - 01/2003
Technological Educational Institute of Crete

- Head (09/2001 - 08/2002) and Deputy Head (09/2002 - 01/2003) of the Electrical Energy and Power Systems Division, Department of Electrical Engineering, School of Applied Technology
- Chair of Curriculum Committee, Department of Electrical Engineering, School of Applied Technology (10/2001 - 01/2003)
- Chair of Student Internship Committee, Department of Electrical Engineering, School of Applied Technology (09/2001 - 01/2003)
- Co-Chair of Staff Recruiting Committee, Department of Electrical Engineering, School of Applied Technology (06/2001 - 06/2002).

06/1997 - 09/1999
UMIST

- Representative of Contract Researchers to Graduate School Council of UMIST
- Representative of Contract Researchers to Committee on Ownership, Distribution and Exploitation of UMIST Technology
- Representative of Overseas Researchers and Departmental Representative to Contract Research Forum of UMIST.

11/1995 - 04/1997 | Probationary Reserve Officer of the Technical Corps of the Hellenic Army; served in 304 and 308 Military Factories, currently Reserve Captain.

## 7. Professional experience

10/2000 - 05/2001 | Special Scientific Staff, New Transmission Projects Department, Public Power Corporation SA; appointment administered by the Supreme Council for Civil Personnel Selection (ASEP)

## 8. Additional information

### I. Professional memberships

- IET, member
- IEEE, Senior member; Dielectrics & Electrical Insulation Society, Power & Energy Society
- CIGRE, member
- European EMTP-ATP Users Group (EEUG), member
- Technical Chamber of Greece, member
- Association of Mechanical and Electrical Engineers of Greece, member

### II. Colloquiums - Seminars

- CIGRE - International Council on Large Electric Systems, Greek National Committee, Conference 'Athens 2002', Athens, 3rd December 2008
- CIGRE - International Council on Large Electric Systems, Greek National Committee, Conference 'Athens 2002', Athens, 11-12 April 2002
- Public Power Corporation S.A., 'Contamination Issues on High Voltage Installations', Heraklion, 26 and 27 April 2001
- CESI, 'CESI Problem Solving Workshop', Athens, 14 February 2001
- Technological Educational Institute of Crete, 'Surface dielectric strength of insulating materials', Seminars of Modern Electro-technology, Heraklion, 23 November 1999 (Lecture)
- UMIST, 'Discharge propagation and flashover over insulating surfaces', Power Systems Seminars, Manchester, 30 April 1999 (Lecture).

- UMIST, 'Surface discharge propagation', Power Systems Seminars, Manchester, 15 October 1998 (Lecture).
- Institution of Electrical Engineers, 'HV measurements, condition monitoring and associated database handling strategies', IEE-Savoy Place, London, 3 June 1998.
- Institution of Electrical Engineers, 'Surface phenomena affecting insulator performance', IEE-Savoy Place, London, 22 January 1998.
- UMIST, 'Career Development for Established Staff', A three-day residential course at Aston Hall, 1998.
- Technical Chamber of Greece, 'Modern techniques in production organization and control', 120hr, Thessaloniki, Greece, 1992.

**III. Other scientific activities**

- Editorial Board Member, IET Science, Measurement & Technology, 2008 - today
- Reviewer for the scientific journals:
  - IET Science, Measurement and Technology
  - IEEE Transactions on Device and Materials Reliability
  - IEEE Transactions on Dielectrics and Electrical Insulation
  - IEEE Transactions on Electromagnetic Compatibility
  - IEEE Transactions on Power Delivery
  - IEEE Transactions on Smart Grid
  - Electric Power Systems Research, Elsevier
  - Simulation Modelling Practice and Theory, Elsevier
  - Journal of Physics D: Applied Physics, Institute of Physics Publishing
  - Measurement Science & Technology, Institute of Physics Publishing
- Member of the Steering Committee of the International Universities' Power Engineering Conference (UPEC), 2003 – today
- Member of the International Program Committee of the Artificial Intelligence in Energy Systems and Power Conference (AIESP), 2006
- Member of the International Advisory Committee of the Mediterranean Conference on Power Generation, Transmission, Distribution and Energy Conversion (MedPower), 2010 and 2012
- Member of the Technical Program Committee of the International Conference on Lightning Protection (ICLP), 2014
- Member of the Organizing Committee for the International Conferences:
  - 38th International Universities' Power Engineering Conference (UPEC 2003)
  - 6th Mediterranean Conference on Power Generation, Transmission, Distribution and Energy Conversion (MedPower 2008)
- Session Chair/Co-Chair for the International Conferences:
  - International Universities' Power Engineering Conference (UPEC), 2004 – 2011 and 2013
  - Mediterranean Conference on Power Generation, Transmission, Distribution and Energy Conversion (MedPower), 2008
  - International Conference on Lightning Protection (ICLP), 2010 and 2012
  - International Symposium on High Voltage Engineering (ISH), 2013
- Member of CIGRE Working Group C4.26 "Evaluation of Lightning Shielding Analysis Methods for EHV and UHV DC and AC Transmission Lines", 2012 - today
- Member of the Scholarships for Postgraduate Studies Examination Committee, Greek State Scholarships Foundation, 2003-2006
- Member of the Continuing Committee TC63 on Hellenic Standards on Lightning Protection of the Hellenic Body for Standardisation (ELOT), 2009 - today
- Member of the Examination Committee for Licensing Electrical and Computer Engineers, Technical Chamber of Greece, 2003 - today
- Member of the National Organisation for the Certification of Qualifications and Vocational Guidance, 2000 - today

- Research Fellow of the Center for Technological Research of Crete, 2001-2003
- Reviewer for Research Proposals
  - Dutch Technology Foundation STW, Netherlands Organisation for Scientific Research, 2011
  - South Africa's National Research Foundation, 2008
  - Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) – Research Funding Programmes: HERACLEITUS I (2003) and HERACLEITUS II (2009)
- Reviewer for the book proposal "Overvoltage protection for telecommunications", IEEE Press Series on Power Engineering: Power and Energy, 2007
- Reviewer for the ELOT 1424 Std (Draft) "Requirements for foundation earthing systems", Hellenic Body for Standardisation (ELOT), 2006

### IV. Scholarships - Distinctions

- Post-Doctoral Scholarship from the Greek State Scholarships Foundation, 01/2000 - 02/2001
- ISH '99 Hydro - Quebec prize paper award, Paper C.9, *11th International Symposium on High Voltage Engineering* (ISH), London, 1999
- Research Associate, High Voltage Laboratory, Electrical Energy and Power Systems Group, Department of Electrical Engineering and Electronics, UMIST, 1997.

## 9. Published work

### I. PhD Thesis

"Influence of humidity and of other parameters on the breakdown mechanism of non-uniform gaps in atmospheric air". High Voltage Laboratory/AUTh, 1995; Supervisor: Professor C.A. Stassinopoulos

### II. Edited Conference Proceedings

Mikropoulos P. N., and Stassinopoulos C. A.: Proceedings of the 38th International Universities' Power Engineering Conference (UPEC 2003), Thessaloniki, 1-3 September 2003.

### III. Publications in Scientific Journals

J1. Mikropoulos P.N., and Stassinopoulos C.A.: "Influence of humidity on the breakdown mechanism of medium length rod - plane gaps stressed by positive impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1994, 141 (5), pp. 407-417

J2. Gourgoulis D.E., Mikropoulos P.N., and Stassinopoulos C.A.: "Sparkover voltage of sphere gaps under standard lightning and switching impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1996, 143 (3), pp. 187-194

J3. Gourgoulis D.E., Mikropoulos P.N., and Stassinopoulos C.A.: "On the corona inception in medium length positive rod - plane gaps under impulse voltages with long wavetails". *Facta Universitatis, Series: Electronics and Energetics*, 1997, 10 (1), pp. 91-105

J4. Gourgoulis D.E., Mikropoulos P.N., and Stassinopoulos C.A.: "Analysis of sphere - rod gaps under standard lightning and switching impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1997, 144 (1), pp. 11-17

J5. Gourgoulis D.E., Mikropoulos P.N., Stassinopoulos C.A., and Yakinthos C.G.: "Behaviour of positive conductor - rod gaps stressed by impulse voltages in atmospheric air". *IEE Proc.-Sci. Meas. Technol.*, 1997, 144 (5), pp. 209-215

J6. Allen N.L., Gourgoulis D.E., Mikropoulos P.N., Stassinopoulos C.A., and Yakinthos C.G.: "Effects of negative direct voltage pre-stressing on the breakdown of conductor-rod gaps under positive impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1998, 145 (3), pp. 105-109

J7. Mikropoulos P.N., and Stassinopoulos C.A.: "Impulse breakdown of short rod - plane gaps and the influence of humidity". *IEE Proc.-Sci. Meas. Technol.*, 1998, 145 (4), pp. 141-146

J8. Allen N.L., and Mikropoulos P.N.: "Dynamics of streamer propagation in air". *J. Phys. D: Appl. Phys.*, 1999, 32 (8), pp. 913-919

J9. Allen N.L., and Mikropoulos P.N.: "Streamer propagation along insulating surfaces". *IEEE Trans. on Dielectrics and Electrical Insulation*, 1999, 6 (3), pp. 357-362

J10. Allen N.L., and Mikropoulos P.N.: "Surface profile effect on streamer propagation and breakdown in air". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2001, 8 (5), pp. 812-817

J11. Gourgoulis D.E., Mikropoulos P.N., Stassinopoulos C.A., and Yakinthos C.G.: “Effects of negative DC pre-stressing on positive impulse breakdown characteristics of conductor-rod gaps”. *IEE Proc.-Sci. Meas. Technol.*, 2005, 152 (4), pp. 155-160

J12. Mikropoulos P.N., and Stassinopoulos C.A.: “Impulse sparkover characteristics of sphere-rod gaps”. *IEE Proc.-Sci. Meas. Technol.*, 2005, 152 (4), pp. 169-174

J13. Mikropoulos P.N., Stassinopoulos C.A. and Sarigiannidou B.C.: “Positive streamer propagation and breakdown in air: the influence of humidity”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2008, 15 (2), pp. 416-425

J14. Lazaridis L.A., and Mikropoulos P.N.: “Flashover along cylindrical insulating surfaces in a non-uniform field under positive switching impulse voltages”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2008, 15 (3), pp. 694-700

J15. Mikropoulos P.N., and Tsovilis T.E.: “Striking distance and interception probability”. *IEEE Trans. on Power Delivery*, 2008, 23 (3), pp. 1571-1580

J16. Mikropoulos P.N.: “Streamer propagation along room-temperature-vulcanised silicon-rubber-coated cylindrical insulators”. *IET Sci. Meas. Technol.*, 2008, 2 (4), pp. 187-195

J17. Mikropoulos P.N., and Tsovilis T.E.: “Interception probability and shielding against lightning”. *IEEE Trans. on Power Delivery*, 2009, 24 (2), pp. 863-873

*As Associate Professor*

J18. Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: “Lightning impulse behaviour of short rod-plane gaps with a dielectric-covered rod”. *IET Sci. Meas. Technol.*, 2010, 4 (2), pp. 53-62

J19. Lazaridis L.A., and Mikropoulos P.N.: “Positive lightning impulse discharges along cylindrical insulating surfaces bridging a short rod-plane gap”. *IET Sci. Meas. Technol.*, 2010, 4 (2), pp. 63-75

J20. Mikropoulos P.N., and Tsovilis T.E.: "Estimation of lightning incidence to overhead transmission lines”. *IEEE Trans. on Power Delivery*, 2010, 25 (3), pp. 1855-1865

J21. Mikropoulos P.N., and Tsovilis T.E.: “Interception probability and proximity effects: Implications in shielding design against lightning”. *IEEE Trans. on Power Delivery*, 2010, 25 (3), pp. 1940-1951

J22. Lazaridis L.A., and Mikropoulos P.N.: “Negative impulse flashover along cylindrical insulating surfaces bridging a short rod-plane gap under variable humidity”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2010, 17 (5), pp. 1585-1591

J23. Mikropoulos P.N., and Tsovilis T.E.: “Lightning attachment models and maximum shielding failure current of overhead transmission lines: Implications in insulation coordination of substations”. *IET Generation, Transmission and Distribution*, 2010, 4 (12), pp. 1299-1313

J24. Lazaridis L.A., and Mikropoulos P.N.: “Positive impulse flashover along smooth cylindrical insulating surfaces under variable humidity”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2011, 18 (3), pp. 745-754

J25. Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: “Impulse behavior of dielectric-covered rod-plane air gaps”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2012, 19 (2), pp. 632-640

J26. Mikropoulos P.N., and Tsovilis T.E.: “Estimation of the shielding performance of overhead transmission lines: The effects of lightning attachment model and lightning crest current distribution”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2012, 19 (6), pp. 2155-2164

J27. Mikropoulos P.N., and Tsovilis T.E.: “Statistical method for the evaluation of the lightning performance of overhead distribution lines”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2013, 20 (1), pp. 202-211

J28. Datsios Z.G, Mikropoulos P.N., and Tsovilis T.E.: “Estimation of the minimum shielding failure flashover current for first and subsequent lightning strokes to overhead transmission lines*”. Electric Power System Research*, 2014, Vol. 113 (SI), pp. 141-150

J29. Mikropoulos P.N., Tsovilis T.E. and Koutoula S.G.: “Lightning performance of distribution transformer feeding GSM base station”. *IEEE Trans. on Power Delivery*, 2014, DOI:10.1109/TPWRD.2014.2335253 (*early access*)

J30. Mikropoulos P.N., and Zagkanas V.N.: “Threshold inception conditions for positive DC corona in the coaxial cylindrical electrode arrangement under variable atmospheric conditions”. *IEEE Trans. on Dielectrics and Electrical Insulation*, 2014 (*in press)*

## IV. Publications in Conference Proceedings

C1. Stassinopoulos C.A., Mikropoulos P.N., and Bagavos C.J.: “On the influence of humidity on positive impulse breakdown of medium rod-plane gaps”. *10th International Conference on Gas Discharges and their Applications*, Swansea, UK, 1992, Vol. 2, pp. 596-599

C2. Stassinopoulos C.A., Mikropoulos P.N., and Bagavos C.J.: “Positive impulse humidity correction factor for medium rod-plane gaps”. *10th International Conference on Gas Discharges and their Applications*, Swansea, UK, 1992, Vol. 2, pp. 600-603

C3. Mikropoulos P.N., and Stassinopoulos C.A.: “Humidity influences on the breakdown of rod-plane gaps under positive impulses in atmospheric air”. *Workshop on Contemporary Problems in Power Engineering*, Thessaloniki, Greece, 1995, pp. 337-343 (Peer-reviewed abstract)

C4. Gourgoulis D.E., Mikropoulos P.N., and Stassinopoulos C.A.: “On the breakdown parameters of medium rod - plane gaps stressed by impulse voltages with long wavetails”. *31st Universities Power Engineering Conference*, Heraklion, Greece, 1996, Vol. 3, pp. 744-747

C5. Mikropoulos P.N., and Stassinopoulos C.A.: “Humidity effect on the properties of coronas preceding breakdown in short positive rod - plane gaps”. *33rd Universities Power Engineering Conference*, Edinburgh, UK, 1998, paper No. 169

C6. Allen N.L., and Mikropoulos P.N.: “On streamer propagation along insulating surfaces”. *CIGRE*, 33-98, (WG04/07) 11 IWD, 1998

C7. Allen N.L., and Mikropoulos P.N.: “Streamer properties in air and in the presence of insulators”. *Institute of Physics Conf. Series: Electrostatics 1999*, Cambridge, UK, 1999, Vol. 163, pp. 49-52

C8. Allen N.L., and Mikropoulos P.N.: “Influence of insulator profile on streamer propagation”. *11th International Symposium on High Voltage Engineering*, London, UK, 1999, paper No. 3.15

C9. Allen N.L., and Mikropoulos P.N.: “Profile effect on surface flashover in a uniform field”. *11th International Symposium on High Voltage Engineering*, London, UK, 1999, paper No. 3.216
**(ISH ‘99 Hydro-Quebec Prize Paper Award)**

C10. Mikropoulos P.N., Stassinopoulos C.A., and Yakinthos C.G.: “Negative DC pre-stressing on conductor-rod gaps under positive impulse voltages”. *X International Symposium on Gaseous Dielectrics*, Athens, Greece, 2004, paper No. 51

C11. Mikropoulos P.N., Stassinopoulos C.A., Katarachias I., and Tsetoglou A.: “Sparkover characteristics of sphere-rod gaps under standard impulse voltages”. *WSEAS Transactions on Circuits and Systems*, Athens, Greece, 2004, Vol. 3, (5), pp. 1197-1200

C12. Mikropoulos P.N., and Stassinopoulos C.A.: “Atmospheric correction procedure in rod-plane gaps up to 1 m in length”. *39th Universities Power Engineering Conference*, Bristol, UK, 2004, Vol. 1, pp. 207-210

C13. Μικρόπουλος Π.Ν., Στασινόπουλος Κ. και Υάκινθος Χ.: “Αύξηση της δυνατότητας μεταφοράς ενέργειας σε υψηλές τάσεις μέσω της συμπίεσης των διακένων”. *1$^{ο}$ Πανελλήνιο Συνέδριο Διπλ. Μηχανολόγων – Ηλεκτρολόγων*, Αθήνα, 2005

C14. Mikropoulos P.N., Sarigiannidou B.C., Stassinopoulos C.A., and Tsakiridis C.: “Influence of humidity on positive streamer propagation and breakdown in a uniform field in air”. *40th Universities Power Engineering Conference*, Cork, Ireland, 2005, Vol. 2, pp. 803-807

C15. Lazaridis L.A., Mikropoulos P.N., Stassinopoulos C.A, Kerasaridis Ch. and Lisaridis I.: “Corona inception in the presence of insulators in a rod-plane gap under positive switching impulse voltages”. *41st Universities Power Engineering Conference, Newcastle*, UK, 2006, Vol. 2, pp. 912-915

C16. Mikropoulos P.N., Stassinopoulos C.A., Stapountzi M., and Sarigiannidou B.C.: “Streamer propagation and flashover along insulator surface in a uniform field in air: influence of humidity”. *41st Universities Power Engineering Conference, Newcastle*, UK, 2006, Vol. 2, pp. 916-920

C17. Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: “Discharge characteristics in short rod-plane gaps under lightning impulse voltages of both polarities”. *42nd Universities Power Engineering Conferenc*e, Brighton, UK, 2007, pp. 1070-1074

C18. Lazaridis L.A., Mikropoulos P.N., and Stassinopoulos C.A.: “Breakdown in air and along a porcelain insulator under positive switching impulse voltages”. *15th International Symposium on High Voltage Engineering*, Ljubljana, Slovenia, 2007, paper No. T4-250, pages 5

C19. Mikropoulos P.N., and Tsovilis T.E.: “Experimental investigation of the Franklin rod protection zone”. *15th International Symposium on High Voltage Engineering*, Ljubljana, Slovenia, 2007, paper No. T4-461

C20. Mikropoulos P.N., and Tsovilis T.E.: “Interception radius and shielding against lightning”. *29th International Conference on Lightning Protection*, Uppsala, Sweden, 2008, paper No. 4-10

C21. Mavroidis P.N., Mikropoulos P.N., Stassinopoulos C.A., Rafailidis P., and Smaragdakis G.: “Impulse breakdown of short rod-plane air gaps with a dielectric covered rod”. *43rd Universities Power Engineering Conference*, Padova, Italy, 2008, paper No. 147

C22. Lazaridis L.A., Mikropoulos P.N., Daras A., and Theocharis A.: “Flashover along cylindrical insulating surfaces under positive lightning impulse voltages”. *XVII International Conference on Gas*

*Discharges and their Applications*, Cardiff, UK, 2008, pp. 233-236

C23. Mavroidis P.N., Mikropoulos P.N., Stassinopoulos C.A., Dodos A., and Zannias P.: “Discharge characteristics in short rod-plane gaps with dielectric-covered rod under lightning impulse voltages”. *XVII Int. Conference on Gas Discharges and their Applications*, Cardiff, UK, 2008, pp. 289-292

C24. Mikropoulos P.N., Tsovilis T.E., and Ananiadis T: “The effect of an earthed object on the interception radius of the Franklin rod: An experimental investigation”. *MedPower 2008*, Thessaloniki, Greece, 2008, paper No. 77 (Peer-reviewed abstract)

C25. Mikropoulos P.N., Tsovilis T.E., Chatzidimitriou P, and Vasilaras P.: “Software development for direct lightning stroke shielding of substations”. *MedPower 2008*, Thessaloniki, Greece, 2008, paper No. 78 (Peer-reviewed abstract)

C26. Mikropoulos P.N., and Tsovilis T.E.: “Lightning attachment models and maximum shielding failure current: Application to transmission lines”. *IEEE PowerTech 2009*, Bucharest, Romania, paper No. 233

C27. Mavroidis P.N., Mikropoulos P.N., Stassinopoulos C.A., and Zinonos M.: “Impulse breakdown of short rod-plane gaps with rod covered with different dielectric materials”. *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 271

C28. Mikropoulos P.N., and Tsovilis T.E.: “A statistical method for lightning incidence calculations in transmission lines”, *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1611

C29. Lazaridis L.A., and Mikropoulos P.N.: “Influence of humidity on positive impulse flashover along cylindrical insulating surfaces bridging a short rod-plane gap”, *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 954

C30. Mikropoulos P.N., and Zagkanas V.N.: “A computational method for positive corona inception in the coaxial cylindrical electrode arrangement in air under variable atmospheric conditions”, *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1606

C31. Mikropoulos P.N., Tzimkas L.C., Giannopoulos T., and Tsintikidis P.: “Positive streamer on propagation along profiled insulating surfaces with room temperature vulcanized silicone rubber coatings”, *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1202

C32. Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: “Impulse corona inception in dielectric covered rod-plane air gaps”. *44th Universities Power Engineering Conference*, Glasgow, Scotland, 2009, paper No. 57-34220

C33. Mikropoulos P.N., and Tsovilis T.E.: “Lightning attachment models and perfect shielding angle of transmission lines”. *44th Universities Power Engineering Conference*, Glasgow, Scotland, 2009, paper No. 57-70151

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*As Associate Professor*

C34. Mikropoulos P.N., and Tsovilis T.E.: "Lightning interception probability and shielding performance of overhead transmission lines". *30th International Conference on Lightning Protection*, Cagliari, Italy, 2010, paper No. 1274

C35. Mikropoulos P.N., Tsovilis T.E., Datsios Z.G., and Mavrikakis N.C.: "Effects of simulation models of overhead transmission line basic components on backflashover surges impinging on GIS substations". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 72

C36. Mikropoulos P.N., Tsovilis T.E., and Zlitidis D.E.: "Software development for the evaluation of the lightning performance of overhead transmission lines". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 84

C37. Mavroidis P.N., Mikropoulos P.N., Stassinopoulos C.A., and Tsirolias L.P.: "Surface corona development in dielectric covered rod-plane air gaps under impulse voltages". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 142

C38. Mikropoulos P.N., and Zagkanas V.N.: "Computation of negative corona inception field strength in the coaxial cylindrical electrode arrangement under variable air density". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 169

C39. Mikropoulos P.N., and Tzimkas L.C.: "Influence of humidity on surface streamer propagation in a uniform field in air". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 239

C40. Mikropoulos P.N., Tsovilis T.E., Manousaridis I., Laloumis G., and Dramis A.: “Lightning risk assessment of a 170 kV GIS substation connected to the Hellenic Transmission System through underground cables”. *MedPower 2010*, Agia Napa, Cyprus, 2010, paper No. 166

C41. Mikropoulos P.N., Tsovilis T.E., Kagiannas A., and Politis Z.: “Evaluation of fast-front overvoltages arising at a 20/0.4 kV distribution transformer”. *MedPower 2010*, Agia Napa, Cyprus, 2010, paper No. 191

C42. Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: “Shielding failure current of overhead transmissions lines generated through an ATPDraw object”. *International Conference on Power Systems Transients - IPST 2011*, Delft, The Netherlands, 2011, paper No. 38.

C43. Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: “Impulse resistance of concentrated tower grounding systems simulated by an ATPDraw object”. *International Conference on Power Systems Transients - IPST 2011*, Delft, The Netherlands, 2011, paper No. 39.

C44. Mikropoulos P.N., and Tsovilis T.E.: “A statistical method for the estimation of induced-voltage flashover rate of unshielded overhead distribution lines,” *17th International Symposium on High Voltage Engineering*, Hannover, Germany, 2011, paper No. B-23.

C45. Mikropoulos P.N., and Zagkanas V.N.: “Modelling of positive corona inception in the coaxial cylindrical electrode arrangement under variable air density”. *17th International Symposium on High Voltage Engineering*, Hannover, Germany, 2011, paper No. E-052

C46. Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: “Insulator string flashover modelling with the aid of an ATPDraw object”. *46th Universities Power Engineering Conference*, Soest, Germany, 2011, paper No. 102

C47. Mikropoulos P.N., Zagkanas V.N., and Koustoulidis T.S.: "Experimental investigation of DC corona on stranded conductors under variable air density". *47th Universities Power Engineering Conference*, London, United Kingdom, 2012, paper No. 112

C48. Mikropoulos P.N., Tsovilis T.E., and Papaioannou P.P.: “Software development for the evaluation of the lightning performance of overhead distribution lines on the basis of the statistical method”. *47th Universities Power Engineering Conference*, London, United Kingdom, 2012, paper No. 141

C49. Datsios Z.G., and Mikropoulos P.N.: “Safe grounding system design for a photovoltaic power station”. *MedPower 2012*, Cagliari, Italy, 2012, paper No. 62

C50. Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: “Estimation of the minimum shielding failure current causing flashover in overhead lines of the Hellenic transmission system”. *31st International Conference on Lightning Protection*, Vienna, Austria, 2012, paper No. 272

C51. Mikropoulos P.N., and Zagkanas V.N.: “The effect of stranded conductor geometry on DC corona in the coaxial cylindrical electrode arrangement in air”. *48th Universities Power Engineering Conference*, Dublin, Ireland, 2013, paper No. 276

C52. Mikropoulos P.N., and Zagkanas V.N.: “Impulse corona inception in the coaxial cylindrical electrode arrangement in air: effects of the steepness of the applied voltage”. *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. PE-50

C53. Datsios Z.G., Mikropoulos P.N., Politis Z., Kagiannas A.G., and Tsovilis T.E.: “Protection of distribution transformer against arising or transferred fast-front overvoltages: Effects of surge arrester connection conductors length”. *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. OB2-04

C54. Mikropoulos P.N., and Tsovilis T.E.: "Evaluation of lightning incidence to ESE rods”. *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. OB2-06

C55. Datsios Z.G., Mikropoulos P.N., Teneketzoglou A., and Tzikas D.: “Safety performance evaluation of fence grounding configurations in high voltage installations”. *49th Universities Power Engineering Conference*, Cluj-Napoca, Romania, 2014, accepted

C56. Mavrikakis N., Siderakis K., and Mikropoulos P.N.: “Laboratory investigation on hydrophobicity and tracking performance of field aged composite insulators”. *49th Universities Power Engineering Conference*, Cluj-Napoca, Romania, 2014, accepted

C57. Datsios Z.G., and Mikropoulos P.N..: “Implementation of leader development models in ATP-EMTP using a Type-94 circuit component”. *32nd International Conference on Lightning Protection*, Shanghai, China, 2014, accepted

C58. Mikropoulos P.N., Tsovilis T.E., and Pori A.S.: “Evaluation of lightning attachment and coupling models for the estimation of the lightning performance of overhead distribution lines”. *32nd International Conference on Lightning Protection*, Shanghai, China, 2014, accepted

## V. Publications in Greek Technical Magazines

G1. Ζ. Γ. Δάτσιος και Π. Ν. Μικρόπουλος, «Σχεδίαση ασφαλούς συστήματος γείωσης για Φ/Β σταθμό», Σύγχρονη Τεχνική Επιθεώρηση [Modern Technical Review], Τεύχος 246, σελ. 16-21, Νοέμβριος-Δεκέμβριος 2012

## 10. Detailed list of citations (Self-citations excluded)

### I. Citations in Dissertations and Books (69)

A1. Gourgoulis DE.: "Electrical breakdown of quasi-uniform and non-uniform gaps in atmospheric air". PhD Thesis, Aristotle University of Thessaloniki, 1997 **(I, J1, C2)**

A2. Pesgens JFT.: "Towards an improved measurement of lightning impulse voltages". Master's Thesis, Technische Universiteit Eindhoven, 1997 **(J2)**

A3. Brettschneider S.: "Contribution à l'étude de l'apparition et du développement des décharges visibles à la surface de la glace", Thèse du doctorat en ingénierie, Université du Québec à Chicoutimi, 2000 **(J9)**

A4. Plank T.: "Positive corona at combined DC and AC voltage". Ph.D. Dissertation, Institute of experimental physics and technology, University of Tartu, Estonia, 2001 **(J8)**

A5. Martinez JA.: "Study of the trajectories of the electrical discharges in air". Ph.D. Dissertation, Instituto Superior Politecnico Jose Antonio Echeverria, Cuba, 2002 **(J10)**

A6. Akyuz M.: "Positive streamer discharges in air and along insulating surfaces: experiment and simulation". Ph.D. Dissertation, Faculty of Science and Technology, Uppsala University, 2002 **(J9)**

A7. Jorgenson RE, Warne LK, Neuber AA, Krile J, Dickens J, Krompholz HG.: "Effect of dielectric photoemission on surface breakdown: An LDRD report". Sandia National Laboratories, U.S. Department of Energy, Report SAND2000-3044 MAY 2003 **(J9)**

A8. Ndiaye I.: "Initiation and développement des décharges couronnes sur une surface de glace". Maitrise en ingénierie, Université du Québec à Chicoutimi, 2003 **(J10)**

A9. Tan BH.: "Corona properties and the dielectric strength of profiled insulator surfaces". Ph.D. Thesis, UMIST, 2003 **(J8, J9, J10)**

A10. Eymerie S.: "Etude expérimentale des décharges atmosphériques générées par impulsions nanosecondes – application au traitement des particules de suie diesel". Thèse de doctorat, Université de Rouen, APR 2003 **(J8, J9)**

A11. Sukhnandan A.: "A theoretical and experimental investigation into fire induced flashover of high voltage transmission lines". Master's Thesis, University of KwaZulu Natal, South Africa, 2005 **(J8)**

A12. Peyda A.: "Numerical and experimental investigation to determine corona inception electric field for rod-plane electrode configuration". Maitrise en ingénierie, Université du Québec à Chicoutimi, 2006 **(C12)**

A13. Madsen SF.: "Interaction between electrical discharges and materials for wind turbine blades – particularly related to lightning protection". Ph.D. Thesis, Ørsted•DTU, Electric Power Engineering, The Technical University of Denmark, 2006 **(J1, J9)**

A14. Ndiaye I.: "Approche physique du développement de streamers positifs sur une surface de glace". Ph.D. Thesis, Université du Québec à Chicoutimi, OCT 2007 **(J8, J9, J10)**

A15. Koliatene F.: "Contribution a l'étude de l'existence des décharges dans les systèmes se l'avionique". PhD Thesis, Université Toulouse III - Paul Sabatier, France, JAN 2009 **(J13)**

A16. Coulibaly ML.: "Caractérisation des décharges électriques se propageant aux interfaces gaz/solide – Relation entre propriétés des matériaux et dimension fractale". PhD Thesis, Ecole Centrale de Lyon, France, SEP 2009 **(J9)**

A17. Yakinthos CG.: " Experimental results for increasing the dielectric strength in non-homogenous gaps: gap compaction in high voltage power lines ". PhD Thesis, Aristotle University of Thessaloniki, Thessaloniki, NOV 2009 **(I, J1, J4, C4)**

A18. Maglaras AL.: "Investigations of the ground effect and of the corona current effects on the dielectric behavior of short air gaps and on the barrier effect". PhD Thesis, National Technical University, Athens, APR 2010 **(C18)**

A19. Deng J.: "Propagation of surface leader discharge in atmospheric air". Ph.D. Thesis, The University of Tokyo, JUN 2010 **(J8)**

A20. Farokhi S.: "Mechanisms of arc propagation over an ice surface". Ph.D. Thesis, Université du Québec à Chicoutimi, SEP 2010 **(J9)**

A21. Tran T N.: "Surface discharge dynamics: Theory, experiment and simulation". PhD Thesis, University of Southampton, SEP 2010 **(J9)**

A22. Duchesne M.: "Étude expérimentale et numérique du courant de fuite sur une couche de glace en présence d'un arc électrique". Maitrise en ingénierie, Université du Québec à Chicoutimi, DEC 2010 **(J9)**

A23. Debit M. : "Etude des phénomènes de préclaquage à l'interface d'une isolation mixte solide/gaz". Magister en Electrotechnique, Université Mouloud Mammeri de Tizi-Ouzou, Algeria, SEP 2011 **(J9)**

A24. Alvarez CGC.: "Um ambiente computacional para analise de desembenho de linhas de transmissao frente as descargas atmosfericas". Master's Thesis, Universidade Federal de São João del-Rei, Brazil, MAR 2011 **(J17, J20, J21)**

A25. Sobota A.: "Breakdown processes in HID lamps - Exploration of various key aspects". PhD Thesis, Technische Universiteit Eindhoven, APR 2011 **(J9, J14)**

A26. Sankar PB.: "Measurement of air breakdown voltage and electric field using standard sphere gap method". Master's Thesis, National Institute of Technology, Rourkela, India, JUN 2011 **(J13)**

A27. Asimakopoulou F.: "Contribution to the investigation of soil ionization", PhD Thesis, National Technical University, Athens, NOV 2011 **(C43)**

A28. Tulaz MO.: "Analise comparative entre os metodos electrogeometrico e dos elementos finitos no projeto de SPDA". MSc Thesis, Universidade Federal de Uberlandia, Brazil, 2012 **(J21)**

A29. Slama M.: "Étude expérimentale et modélisation de l'influence de la constitution chimique et de la répartition de la pollution sur le contournement des isolateurs haute tension". PhD Thesis, Ecole Centrale de Lyon, France, FEB 2012 **(J9)**

A30. Clark DA.: "Electromagnetic fast-transients in LV networks with ubiquitous small-scale embedded generation". PhD Thesis, Cardiff University, MAR 2012 **(C41)**

A31. Sili E.: "Etude et caractérisation des décharges partielles et du vieillissement du polyimide en environnement

aéronautique". PhD Thesis, Université Toulouse III - Paul Sabatier, France, DEC 2012 **(J13)**

A32. Kumara S.: "Electrical charges on polymeric insulator surfaces and their impact on flashover performance". PhD Thesis, Chalmers University of Technology, Sweden, DEC 2012, **(J9, J10, J14, J22, C22)**

A33. Kamarudin MS.: "Experimental investigation of $CF_3I$-$CO_2$ gas mixtures on the breakdown characteristics in uniform and non-uniform field configurations". PhD Thesis, Cardiff University, JUN 2013 **(C17)**

A34. Sadaoui F.: " Comparaison des caractéristiques électriques et optiques des décharges glissantes sur différents types d'isolateurs dans le $CO_2$, le $SF_6$ et le $N_2$ et leurs mélanges à différentes pressions". PhD Thesis, Ecole Centrale de Lyon, France, SEP 2013 **(J9)**

A35. Tulaz MO.: "Optimization of location and number of lightning arresters in 420 kV substations in Turkish high voltage electricity system". MSc Thesis, Middle East Technical University, Turkey, FEB 2014 **(C35)**

A36. Warne LK, Jorgenson RE, Lehr JM, Wallace ZR, Hodge KC.: "Surface interactions involved in flashover with high density electronegative gases". Sandia National Laboratories, U.S. Department of Energy, Report SAND2010-0268 JAN 2010 **(J9)**

A37. Schweickart D, Horwath J, Walko L, Hatfield L, Krompholz H.: "A guide to electrical insulation design in aerospace vehicles for a broad range of environmental parameter space". Energy and Power Systems Branch, Energy/Power/Thermal Division, Air Force Research Laboratory, Propulsion Directorate, Wright-Patterson Air Force Base, OH 45433-7251, Air Force Materiel Command, United States Air Force, Report AFRL-RZ-WP-TR-2010-2119 MAR 2010 **(J10)**

A38. Insulation of High-Voltage Equipment, VY Ushakov, Springer-Verlag Power Systems Series, ISBN: 9783540207290, 2004 (**J1, J2, J6**)

A39. Advances in High Voltage Engineering, M. Haddad and D. Warne (Eds.), IEE Power & Energy Series 40, ISBN: 0852961588, 2004 **(J8)**

A40. Gaseous Electronics: Theory and Practice, GG Raju, CRC Press, Taylor & Francis Group, ISBN: 0849337631, 2006 **(J1, J4)**

A41. Christen T, Böhme H, Pedersen A, Blaszczyk A.: "Streamer Line Modeling" in Scientific Computing in Electrical Engineering SCEE 2010, Mathematics in Industry 16, B. Michielsen and J.-R. Poirier (Eds.), Springer-Verlag Berlin Heidelberg, 16, DOI 10.1007/978-3-642-22453-9_19, 2012 **(J8)**

A42. Locke BR., Lukes P., Brisset JL.: "Elementary Chemical and Physical Phenomena in Electrical Discharge Plasma in Gas–Liquid Environments and in Liquids" in Plasma Chemistry and Catalysis in Gases and Liquids, Wiley Online Library, DOI: 10.1002/9783527649525.ch6, 2012 **(J13, C16)**

A43. Rodrigo H.: "The Behavior of Polymer-based Dielectrics under Cryogenic Conditions" in Polymers at Cryogenic Temperatures, Susheel Kalia and Shao-Yun Fu (Eds.), Springer, ISBN: 9783642353352, 2013 **(J9)**

A44. Takaki K.: "Air remediation using non-thermal plasmas" in Air pollution: Sources, prevention and health effects, Rajat Sethi (Ed.), Nova Science Publishers, ISBN: 978-1-62417-735-4, 2013 **(J8)**

A45. High- Voltage Test and Measuring Techniques, Wolfgang Hauschild and Eberhard Lemke, Springer- Verlag Berlin Heidelberg, DOI: 10.1007/978-3-642-45352-6_1, 2014 **(J13, J22, J24)**

## II. Citations in Conference papers and Articles not indexed by Web of Science™ (96)

B1. Yang B, Wang L, Guan Z, Liang X.: "Air breakdown in conductor-rod gap with direct or alternating voltage switching impulses". *JOURNAL OF TSINGHUA UNIVERSITY* 42: 49-51, JUL 2002 **(J5)**

B2. Farzaneh M, Fofana I, Ndiaye I, Volat C, Srivastava KD.: "Corona streamer inception at an ice surface". *IASTED Conference on Power and Energy Systems 2002*, (EuroPES), Crete, 2002, paper 369-113 **(J10)**

B3. Rider G.: "Estimation of the field induced damage thresholds in recticles". *Semiconductor Manufacturing Magazine*, FEB 2004, pages 9 **(J10)**

B4. Santos E, Fouracre RA, MacGregor SJ.: "Discharge velocity effects across charged insulators". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Colorado, OCT 2004 **(J9)**

B5. Chagny MP, Naoum JA.: "A methodology for characterizing system-level ESD sensitivity". *30th International Symposium for Testing and Failure Analysis* (ISTFA), 2004, pp. 277-282 **(J1)**

B6. Madsen SF, Holbøll J, Henriksen M, Krog-Pedersen S.: "Breakdown tests of composite materials and the importance of the volume effect". *19th Nordic Insulation Symposium 2005* (NORD-IS 05), Trondheim, JUN 2005, pp. 91-94 **(J9)**

B7. Jiang XL, Wang J, Hu JL, Zhang ZJ, Sun CX.: "Positive polarity switching impulse discharge performance and voltage correction of 1 m rod-plane air gap". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 26 (16): 137-143 AUG 2006 **(J1)**

B8. Madsen SF, Holbøll J, Henriksen M, Bertelsen K., and Erichsen HV.: "New test method for evaluating the lightning protection system on wind turbine blades". *28th International Conference on Lightning Protection* (ICLP), Kanazawa, Japan, SEP 2006, paper no. XI-4 **(J1)**

B9. Javadi H., Farzaneh M., Peyda A.: "Experimental Investigation to determine corona inception electric field using a rod-plane configuration". *21st International Power System Conference* (PSC), Tehran, Iran, NOV 2006, pp. 1937-1945 **(C12)**

B10. Jiang XL, Wang J, Yuan JH, Hu JL, Zhang ZJ.: "Correction method of positive switching impulse discharge voltage for 0.5-1.0 m air gap under artificial and natural conditions". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 28 (28): 13-17 OCT 2008 **(J1)**

B11. Ma K, Zhang GJ, Yu K, Zheng N, Yan Z.: "Electric field analysis of typical surface insulation configurations in vacuum". GAOYA DIANQI/HIGH VOLTAGE APPARATUS 44 (1); 15-19 2008 **(C9)**

B12. Yongli L, Liming W, Ke W, Canlin W, Zhicheng G.: "Ultraviolet corona discharge detection based on photomultiplier". IEEJ TRANSACTIONS ON FUNDAMENTALS AND MATERIALS, 128 (5): 357-366 2008 **(J8)**

B13. Hirata T, Koga M, Ueno H, Nakayama H.: "Characteristics of creeping discharge developed in narrow gap on a filamentous backside electrodes". IEEJ TRANSACTIONS ON FUNDAMENTALS AND MATERIALS, 128-A (7): 483-489

JUL 2008 **(J9)**

B14. Ndiaye I, Farzaneh M, Srivastava KD.: "Experimental study and analysis of the stability field for a streamer propagating along an ice surface". JOURNAL OF HIGH VOLTAGE ENGINEERING, 35 (6): 1284-1293 JUN 2009 **(J9)**

B15. Kuznetsov V.H., Hasimov A.M., Kurbanov E.D.: "Analysis of the structure of nanosecond streamer discharge by electrography method". Tekhnichna Elektrodynamika, 6: 17-22 JUN 2009 **(C8, C9)**

B16. Tanaka D., Matsuoka S., Kumada A., Hidaka K.: "Two-dimensional potential and charge distributions on insulators with propagating positive surface streamer". *29th International Conference on Phenomena in Ionized Gases* (ICPIG), Cancun, Mexico, JUL 2009, paper no. PB10-5 **(J8)**

B17. Zhou H, Theethayi N, Diendorfer G, Thottappillil R, Rakov VA .: "A new approach to estimation of effective height of towers on mountain tops for lightning incidence studies: sensitivity analysis". *X International Symposium on Lightning Protection*, (SIPDA), Curitiba, Brasil, NOV 2009, pp. 439-443 **(J13)**

B18. Takaki M, Ryoichi H, Toshiyuki N, Shinzo T, Yasunori K.: "Distinctive discharge generated under impulse voltage and negative creeping discharge along aerial insulated cable". IEEJ TRANSACTIONS ON FUNDAMENTALS AND MATERIALS, 130 (11): 993-998 2010 **(J9)**

B19. Javadi H., Farzaneh M., Peyda A.: "Determination of electric field at inception based upon current-voltage characteristics of AC corona in rod-plane gaps". IRANIAN JOURNAL OF ELECTRICAL & ELECTRONIC ENGINEERING, 6 (2); 119-128 JUN 2010 **(C12)**

B20. Gubanski SM.: "Role of surface charging in the performance of polymeric high voltage insulation systems". *10th IEEE International Conference on Solid Dielectrics*, (ICSD2010), Potsdam, Germany, JUL 2010, pp. 1-11 **(C9)**

B21. Wang LM, Meng XB, Bian XM, Guan ZC, Yang YJ, Wu X, Chen Y.: "Overview of streamer propagation along insulation surfaces in the uniform field". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 36 (10); 2405-2411 OCT 2010 **(J8, J9, J10, J16)**

B22. Zheng J, Xie L, Zhao Y, Yang J, Chu J, Wang L, Guan Z.: "Study on the discharge characteristics of multiple spark gaps connected with frequency-dependent network". *Zhongguo Dianji Gongcheng Xuebao/* Proc. of the Chinese Society of Electrical Engineering 30 (34): 118-124 DEC 2010 **(J12, C17)**

B23. Struzhevski P.: "About the necessity of relation's modification between striking distance and lightning peak current recommended by European Standard EN 62305-1". TEKHNICHNA ELEKTRODYNAMIKA, Institute of Electrodynamics National Academy of Science of Ukraine, 1: 61-65 JAN 2011 **(J17)**

B24. Malik MA, Schoenbach KH.: "A novel pulsed corona discharge reactor based on surface streamers for NO conversion from $N_2$-$O_2$ mixture gases". INTERNATIONAL JOURNAL OF PLASMA ENVIRONMENTAL SCIENCE AND TECHNOLOGY 5 (1); 50-57 MAR 2011 **(J9)**

B25. Yagi I, Takaki K, Go T, Namihira T.: "Improvement of ozone yield using double loop type inductive energy storage circuit". *18th IEEE International Pulsed Power Conference* (PPC), Chicago, IL, JUN 2011, Article number 6191597, Pages 1266-1271 **(J8)**

B26. Meng X, Hui J, Bian X, Chen F, Wang L, Guan Z, Chen Y.: "Research on the characteristic of streamer discharge at low air pressure". *Zhongguo Dianji Gongcheng Xuebao/* Proc. of the Chinese Society of Electrical Engineering 31 (25): 139-149 SEP 2011 **(J8, J16)**

B27. Zhang L, Hui JF, Meng XB, Bian XM, Wang LM, Guan ZC.: "The simulation of streamer dynamics in the air gap". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Cancun, OCT 2011, pp. 728-731 **(J8)**

B28. Xie Y, Dong M, He H, He J, Cai H, Chen X.: "A new tool for lightning performance assessment of overhead transmission lines". *7th Asia-Pacific International Conference on Lightning*, (APL), Chengdu, China, NOV 2011, pp. 513-519 **(J20)**

B29. Xie S, He H, He J, Chen W, Chen J, Gu S, Xiang N.: "Observation on the attachment processes of competition tests under switching impulse voltage". *7th Asia-Pacific International Conference on Lightning*, (APL), Chengdu, China, NOV 2011, pp. 525-528 **(J17)**

B30. Bouregba N, Benmimoun Y, Tilmatine A.: "Prototype decontamination of water by ozone". *1st International Conference on Water, Energy and Environment* (ICWEE), NOV 2011, pp. 85-89 **(J9)**

B31. Thanasaksiri T.: "Studies of lightning overvoltages of 115 kV CMU GIS substation". *9th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology* (ECTI-CON 2012), MAY 2012, pages 1-4 **(C35, C40)**

B32. Nada S, Hamed M.: "Statistical transients in transmission systems". INTERNATIONAL JOURNAL OF AUTOMATION AND POWER ENGINEERING 1 (2); 47-60 MAY 2012 **(J23)**

B33. Karmakar S.: "An experimental study of air breakdown voltage and its effects on solid insulation". JOURNAL OF ELECTRICAL SYSTEMS 8 (2); 209-217 JUN 2012 **(J13)**

B34. Mahmoudian Y, Jazaeri M.: "Ranking of Iran 400kV transmission line towers from view point of protection against lightning stroke". AMERICAN JOURNAL OF SCIENTIFIC RESEARCH, Issue 63; 111-119 JUN 2012 **(C19, C20, C26)**

B35. Machidon D, Istrate M, Gusa M, Dragomir M.: "The elliptic model implementation for the estimation of the vertical rods' protection zones". *9th World Energy Systems Conference* (WESC), Buletinul AGIR nr. 3/2012 unie-august, 477-481 **(J15)**

B36. Sima W, Li Y, Yang Q, Yuan T, Qin B.: "Improved grid method and its application to statistics of lightning parameters". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 38 (8); 1834-1841 AUG 2012 **(J20)**

B37. Xie S, He H, Xiang N, Gu S, Wan J, Chen W, He J, Chen J, Qian G, Cheng Z.: "Experimental study on the discharge processes of rod-rod air gap under switching impulse voltage". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 38 (8); 2083-2090 AUG 2012 **(J21)**

B38. Li Z, Zeng R, Zhuang C, Chen S, Liao Y, Gao C.: "Simulating experiment based on the initiation and propagation characteristics of upward leader from transmission lines". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 38 (8); 2012-2082 AUG 2012 **(C26)**

B39. Deng J, Matsuoka S, Kumada A, Hidaka K, Pu L, Zhang G.: "Effect of residual charges on surface discharge propagation under impulse voltage". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 38 (8); 2137-2144 AUG

2012 **(J8)**

B40. Shi J, Yang Q, Sima W, Yuan T, Peng Q.: "Surface streamer characteristics in air based on plasmochemical model". INTERNATIONAL REVIEW OF ELECTRICAL ENGINEERING 7 (4) Part b; 5230-5239 JUL-AUG 2012 **(J8)**

B41. Liao Y, Jia L, Li Z; Zeng R, Chen S.: "Research on the characteristics of upward leader emerging from the transmission lines influenced by operation voltage". *31st International Conference on Lightning Protection* (ICLP), Vienna, Austria, SEPT 2012, pages 1-4 **(J6)**

B42. Gu S, Xiang N, Chen J, He H, Xie SJ, Chen W.: "Observation of 3m rod-rod discharges under switching impulse voltage". *31st International Conference on Lightning Protection* (ICLP), Vienna, Austria, SEPT 2012, pages 1-4 **(J21)**

B43. Gomes C, Cooray V, Rahman M.: "Breakdown characteristics and optically visible discharge paths of surface flashover". *IEEE Conference on Sustainable Utilization and Development in Engineering and Technology* (STUDENT), OCT 2012, pp. 111-116 **(J9, J14, J19, J22, C18)**

B44. Li Z, Zeng R, Zhuang C, Liao Y, Gao C.: "Influence of DC operation voltage on the initiation and propagation characteristics of upward leader from transmission lines under lightning". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 39 (6); 1344-1351 JUN 2013 **(J6)**

B45. Maglaras A, Kousiouris T, Topalis F, Katsaros D, Maglaras LA, Giannakopoulou K.: "Method of controlling corona effects and breakdown voltage of small air gaps stressed by impulse voltages". *IEEE Electrical Insulation Conference* (EIC), Ottawa, Canada, JUN 2013, paper No. 140 **(C18)**

B46. Maglaras A, Kousiouris T, Topalis F, Maglaras LA, Giannakopoulou K.: "Optimization of corona onset and breakdown voltage of small air gaps stressed by DC and impulse voltages". *IEEE EuroCon*, Zagreb, Croatia, JUL 2013, 6625134, pp. 1207-1214 **(C18)**

B47. Chvyreva A, Pemen AJM, Christen T.: "Investigation of streamer propagation along insulating surfaces". *31st International Conference on Phenomena in Ionized Gases* (ICPIG), Granada, Spain, JUL 2013, paper no. PS2-068 **(J9)**

B48. Goll F, Witzmann R, Neumann C, Imamovic D.: "Application and potential of integrated surge arresters in Gas Insulated Transmission Lines (GIL) for lightning overvoltages". *18th International Symposium on High Voltage Engineering* (ISH), Seoul, Korea, AUG 2013, paper No. OB3_02 **(C35)**

B49. Diaz RR, Segovia AA.: "Humidity corrections and front time tolerance for lightning impulse voltages in metric air gap". *18th International Symposium on High Voltage Engineering* (ISH), Seoul, Korea, AUG 2013, paper No. PC_02 **(C12)**

B50. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Research on characteristics of streamer propagation along insulator surfaces". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 33 (22): 155-165 AUG 2013 **(J8, J9, J16)**

B51. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Research on characteristics of streamer propagation along insulator surfaces". *Zhongguo Dianji Gongcheng Xuebao*/Proc. of the Chinese Society of Electrical Engineering 33 (22); 155-165 AUG 2013 **(J8, J9, J16)**

B52. CIGRE Working Group C4.407.: "Lightning Parameters for Engineering Applications" CIGRE TB; 1-117 AUG 2013 **(J23)**

B53. Christoforiis G, Papadopoulos T, Parisses C, Micu DD, Czumbil L.: "Interference analysis from medium-voltage cables of photovoltaic plants to metallic pipelines". *48th Universities Power Engineering Conference* (UPEC) Dublin, Ireland, SEP 2013, paper No. 304 **(C49)**

B54. Khodja F, Mimoun Y, Kherfane RL.: "The streamers dynamics study by an intelligent system based on Neural Networks". *The 2013 International Conference on Environment, Energy, Ecosystems and Development* (EEEAD), Venice, Italy, SEP 2013, pp. 202-206 **(J9)**

B55. Lobato AT, Schroeder MAO, Cruz DE, Reis MR, Moura RAR, Sales WS, Nascimento LC, Assis SC.: "Analysis of the cumulative probability distribution of the stroke angle in lightning incidence to three-phase overhead transmission lines". *XII International Symposium on Lightning Protection* (XII SIPDA), Belo Horizonte, Brazil, OCT 2013, pp. 128-133 **(J20)**

B56. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Influence of curved profiles on characteristics of streamer propagation along the insulator surfaces". DIANGONG JISHU XUEBAO/TRANSACTIONS OF CHINA ELECTROTECHNICAL SOCIETY, 28 (11); 278-285 NOV 2013 **(J8, J9, J10)**

B57. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Influence of shed configuration on characteristics of streamer propagation along the insulation surfaces". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 34 (3): 468-477 JAN 2014 **(J9, J10)**

B58. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Quantitative effects of dielectric constant and surface properties on streamer propagation along the insulation surface". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 34 (9): 1490-1497 2014 **(J8, J9, J16)**

B59. Zhang C, Meng X, Zhang F, Li R, Ma Y, Mei H, Wang L, Guan Z.: "Research on the DC rain flashover mechanism of polluted post insulators". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 34 (9): 1481-1489 2014 **(J9)**

B60. Zhan H, Liu B, Shi W, Yan T, Li C.: "Influence of space charge on air gap discharge under switching impulse". GAOYA DIANQI/HIGH VOLTAGE APPARATUS 50 (2); 92-98 FEB 2014 **(J6)**

B61. Nourirad G., Izadi M., Gomes C., Ab Kadir MZA.: "Characterizing the breakdown behavior of Rod-plane air gap under impulse over-voltage". *IEEE 8th International Power* Engineering and Optimization Conference (PEOCO), Langkawi, The Jewel of Kedah, Malaysia, MAR 2014, Article number 6814471 **(J1)**

B62. Colak I, Garip I, Issi F.: "An application of maintaining constant grounding resistance of renewable energy sources by using a Dspic". *9th International Conference on Ecological Vehicles and Renewable Energies* (EVER), Monte-Carlo, Monaco, MAR 2014 **(C49)**

B63. Benesz M, Tarko R.: "Analysis of disturbances in electric power systems caused by lightning discharges". IAPGOŚ 1; 54-57, 2014 **(J20)**

B64. Malcom N, Aggarwal RK.: "An analysis of reducing back flashover faults with surge arresters on 69/138 kV double circuit transmission lines due to direct lightning strikes on the shield wires". *12th IET International Conference on Developments in Power System Protection* (DPSP), Copenhagen, Denmark, APR 2014, DOI: 10.1049/cp.2014.0070 **(J27)**

B65. Meng X, Mei H, Chen C, Wang L, Guan Z, Zhou J.: "Experimental research on influences of air pressure and humidity on characteristics of streamer propagation along insulation surfaces". *Zhongguo Dianji Gongcheng Xuebao*/ Proc. of the Chinese Society of Electrical Engineering 34 (12): 1938-1947 APR 2014 **(J8, J9, J13, J16)**

B66. Wang L, Zhu B, Meng X, Mei H, Guan Z, Zhou J.: "Experimental study on streamer discharge characteristics along contamination insulator surface". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 40 (4); 972-978 APR 2014 **(J9)**

B67. Yao C, Wang Q, Wu H, Long Y, Ma Y, Shen Y.: "Direct lightning identification method and its application based on fault phase selection and time/frequency domain analysis". GAODIANYA JISHU/HIGH VOLTAGE ENGINEERING 40 (5); 1298-1305 MAY 2014 **(J23)**

B68. Olason D, Ebdrup T, Pedersen K, Da Silva FF, Leth Bak C.: "A comparison of the lightning performance of the newly designed Eagle pylon and the traditional Donau pylon, based on tower geometry". *International Colloquium on Lightning and Power Systems (CIGRE)*, Lyon, France, MAY 2014, p. 12 **(J23)**

B69. Shah BS, Parmar SB, Rathod JN, Pandya AS.: "Measurement of air breakdown voltage and electric Field using standard sphere gap method". INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY, 2 (VI); 180-186, JUN 2014 **(J13)**

B70. Wang L, Meng X, Mei H, Guan Z.: "Characteristics of streamer propagation along insulation surface: influence of dielectric material and shed configuration". *20th International Conference on Gas Discharges and their Applications*, Orleans, France, JUL 2014, paper 42492 **(J9)**

B71. Zubair AR, Olatunbosun A.: "Arithmetic and logical models of stranded transmission line conductors for voltage and voltage-drop analysis". INTERNATIONAL JOURNAL OF INNOVATION AND SCIENTIFIC RESEARCH, 8(2); 200-209, SEP 2014 **(C51)**

## III. Citations in Conference papers and Articles indexed by Web of Science™ (97)

C1. Messaoudi R, Younsi A, Massines F, Despax B, Mayoux C.: "Influence of humidity on current waveform and light emission of a low-frequency discharge controlled by a dielectric barrier". IEEE T DIELECT EL IN 3 (4): 537-543 AUG 1996 **(C1)**

C2. Allen NL, Huang CF, Cornick KJ, Greaves DA.: "Sparkover in the conductor-rod and conductor-plane test gaps under composite slow front impulse/direct voltages". IEE P-SCI MEAS TECH 146 (3): 135-141 MAY 1999 **(J5)**

C3. Allen NL, Wang LM, Greaves DA.: "Air breakdown in the conductor-rod gap under composite slow-front impulse/alternating voltages". IEE P-SCI MEAS TECH 146 (5): 217-225 SEP 1999 **(J5)**

C4. Kulikovsky AA.: "The role of the absorption length of photoionizing radiation in streamer dynamics in weak fields: a characteristic scale of ionization domain". J PHYS D APPL PHYS 33 (1): L5-L7 JAN 7 2000 **(J8)**

C5. Kulikovsky AA.: "The role of photoionization in positive streamer dynamics". J PHYS D APPL PHYS 33 (12): 1514-1524 JUN 21 2000 **(J8)**

C6. Van Brunt RJ, Nelson TL, Stricklett KL.: "Early streamer emission lightning protection systems: An overview". IEEE ELECTR INSUL M 16 (1): 5-24 JAN-FEB 2000 **(J1)**

C7. Akyuz M, Gao L, Cooray V, Gubanski SM, Larsson A.: "Positive streamer discharges along insulating surfaces". IEEE T DIELECT EL IN 8 (6): 902-910 DEC 2001 **(J9)**

C8. Kumada A, Sugihara T, Chiba M, Hidaka K.: "Two-dimensional potential distribution measurement of surface discharge with subnanosecond resolution". REV SCI INSTRUM 73 (4): 1939-1944 APR 2002 **(J9)**

C9. Sam YL, Lewin PL, Davies AE, Wilkinson JS, Sutton SJ, Swingler SG.: "Surface discharge measurements of polymeric materials". IEE P-SCI MEAS TECH 150 (2): 43-52 MAR 2003 **(J9)**

C10. Tardiveau P, Marode E.: "Point-to-plane discharge dynamics in the presence of dielectric droplets". J PHYS D APPL PHYS 36 (10): 1204-1211 MAY 21 2003 **(J9)**

C11. Hallac A, Georghiou GE, Metaxas AC.: "Secondary emission effects on streamer branching in transient non-uniform short-gap discharges". J PHYS D APPL PHYS 36 (20): 2498-2509 OCT 21 2003 **(J8)**

C12. Brettschneider S, Farzaneh M, Srivastava KD.: "Nanosecond streak photography of discharge initiation on ice surfaces". IEEE T DIELECT EL IN 11 (3): 450-460 JUN 2004 **(J9)**

C13. Malik MA, Minamitani Y, Schoenbach KH.: "Comparison of catalytic activity of aluminum oxide and silica gel for decomposition of volatile organic compounds (VOCs) in a plasmacatalytic reactor". IEEE T PLASMA SCI 33 (1): 50-56 Part 1 FEB 2005 **(J9)**

C14. Akyuz M, Cortet PP, Cooray V.: "Positive streamer discharges along liquid dielectric surfaces: effect of dielectric constant and surface properties". IEEE T DIELECT EL IN 12 (3): 579-585 JUN 2005 **(J9)**

C15. Akyuz M, Rahman M, Larsson A, Cooray V, Franke A.: "Characteristics of laser-triggered electric discharges in air". IEEE T DIELECT EL IN 12 (5): 1060-1070 OCT 2005 **(J8)**

C16. Takaki K, Ohmukai R, Mukaigawa S, Fujiwara T, Miura T, Mase H, Sato N.: "Energy control of capacity-coupled discharge in atmospheric air". JPN J APPL PHYS 45 (3A): 1797-1800 MAR 2006 **(J8)**

C17. Jiang XL, Bai y, Hu JL, Zhang ZJ.: "Positive switching impulse discharge performance and voltage correction of 1 meter rod-plane air gap". *International Conference on Power System Technology* (POWERCON), Chongqing, China, OCT 2006, pp. 1-7 **(J1, J7, J12, C12)**

C18. Hu JL, Jiang XL, Wang SH, Zhang ZJ, Sun CX, Shu LC, Wang J.: "Positive switching impulse discharge performance and voltage correction of 1-m rod-plane air gap". IEEE T POWER DELIVER 22 (2): 1247-1254 APR 2007 **(J1, J7, J12, C12)**

C19. Settaouti A, Settaouti, L.: "Numerical simulation of the formation and propagation of streamer". INT J MOD PHYS C 18 (6): 957-971 JUN 2007 **(J8)**

C20. Settaouti A, Settaouti L.: "Numerical simulation of corona discharge in $N_2$". J ELECTROSTAT 65 (10-11): 625-630 OCT 2007 **(J8)**

C21. Ndiaye I, Farzaneh M, Fofana I.: "Study of the development of positive streamers along an ice surface". IEEE T

DIELECT EL IN 14 (6): 1436-1445 DEC 2007 **(J9)**

C22. Settaouti A, Settaouti L.: "Numerical simulation of streamer propagation in oxygen". INT J MOD PHYS B 22 (3): 293-307 JAN 2008 **(J8)**

C23. Hui JF, Guan ZC, Wang LM, Li Q.: "Variation of the dynamics of positive streamer with pressure and humidity in air". IEEE T DIELECT EL IN 15 (2); 382-389 APR 2008 **(J8)**

C24. Petersen D, Bailey M, Beasley WH, Hallett J.: "A brief review of the problem of lightning initiation and a hypothesis of initial lightning leader formation". J GEOPHYSICAL RESEARCH: ATMOSPHERES, 113 (D17), D17205, SEP 2008 **(J8)**

C25. Ndiaye I, Farzaneh M, Fofana I.: "A comparative study of positive and negative streamer development along an ice surface". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Québec City, Canada, OCT 2008, pp. 128-131 **(J9)**

C26. Ndiaye I, Farzaneh M.: "Empirical laws governing ice surface discharges". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Québec City, Canada, OCT 2008, pp. 333-336 **(J9)**

C27. Ndiaye I, Farzaneh M, Srivastava KD.: "On the streamer stability field for a positive discharge propagating along an ice surface". *International Conference on High Voltage Engineering and Application* (ICHVE), Chongqing, China, NOV 2008, pp. 40-44 **(J9)**

C28. Sobota A, Lebouvier A, Kramer NJ, van Veldhuizen EM, Stoffels WW, Manders F, Haverlag M.: "Speed of streamers in argon over a flat surface of a dielectric". J PHYS D APPL PHYS 42 (1), Article number: 015211 JAN 2009 **(J9)**

C29. Jiang XL, Shu LC, Hu JL, Zhang ZJ, Wang SH, Yuan J.: "Positive switching impulse discharge performance and voltage correction of rod-plane air gap based on tests at high-altitude sites". IEEE T POWER DELIVER 24 (1): 302-310 JAN 2009 **(J1)**

C30. Maglaras A, Topalis FV.: "Influence of ground and corona currents on dielectric behavior of small air gaps". IEEE T DIELECT EL IN 16 (1); 32-41 FEB 2009 **(C18)**

C31. Tanaka D., Matsuoka S., Kumada A., Hidaka K.: "Two-dimensional potential and charge distributions of positive surface streamer". J PHYS D APPL PHYS 42 (7) Article number: 075204 APR 2009 **(J9)**

C32. Papageorghiou L, Panousis E, Loiseau JF, Spyrou N, Held B.: "Two-dimensional modelling of a nitrogen dielectric barrier discharge (DBD) at atmospheric pressure: filament dynamics with the dielectric barrier on the cathode". J PHYS D APPL PHYS 42 (10) Article number: 105201 APR 2009 **(J8)**

C33. Rodriguez D, Gorur RS, Hansen PM.: "Effect of Humidity on the breakdown characteristics of air in uniform field for the very low frequency (VLF) band". IEEE T DIELECT EL IN 16 (5); 1397-1403 OCT 2009 **(J13)**

C34. Kishore NK, Punekar GS, Shastry HSY.: "Sparkover in sphere gaps with alternating voltages and perturbed electric fields". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Virginia Beach, VA, OCT 2009, pp. 698-701 **(J12)**

C35. Rodriguez D, Gorur RS, Hansen PM.: "Effect of humidity on the breakdown characteristics of air in non-uniform fields at 30 kHz". IEEE T DIELECT EL IN 17 (1); 45-52 FEB 2010 **(J7, J13)**

C36. Akses A., Kalenderli O.: "Flashover processes between conductive paths on a circuit board under very fast impulse voltages". IEEE T DEVICE MAT RE, 10 (1); 87-91 MAR 2010 **(C9)**

C37. Hirata T, Koga M, Ueno H, Nakayama H.: "Characteristics of creeping discharge developed in narrow gap on a filamentous backside electrodes". ELECTR ENG JPN, 171 (1): 1-9 APR 2010 **(J9)**

C38. Settaouti A.: "Monte Carlo simulation of avalanche formation and streamer discharge". ELECTR ENG 92 (1); 35-42 JUN 2010 **(J8)**

C39. Settaouti A, Settaouti, L.: "Monte Carlo simulation of positive corona discharge in Nitrogen". INT J MOD PHYS C 21 (7); 943-954 JUL 2010 **(J8)**

C40. Settaouti A, Settaouti, L.: "Monte Carlo simulation of corona discharge in $SF_6$". ELECTR POW SYST RES 80 (9); 1104-1110 SEP 2010 **(J8)**

C41. Zhou H, Theethayi N, Diendorfer G, Thottappillil R, Rakov VA .: "On estimation of the effective height of towers on mountaintops in lightning incidence studies". J ELECTROSTAT 68 (5): 415-418 OCT 2010 **(J13)**

C42. Jansky J, Tholin F, Bonaventura Z, Bourdon A.: "Simulation of the discharge propagation in a capillary tube in air at atmospheric pressure". J PHYS D APPL PHYS 43 (39), 395201 OCT 2010 **(J9)**

C43. Settaouti A, Settaouti, L.: "Monte Carlo simulation of electrical corona discharge in air". ELECTR POW SYST RES 81 (1); 84-89 JAN 2011 **(J8)**

C44. Mu HB, Zhang GJ, Komiyama Y, Suzuki S, Miyake H, Tanaka Y, Takada T.: "Investigation of surface discharges on different polymeric materials under HVAC in atmospheric air". IEEE T DIELECT EL IN 18 (2); 485-494 APR 2011 **(J8)**

C45. Majidi M, Javadi H.: "Feasible installation of Transmission Line Surge Arresters to Decrease Lightning Transient Over-Voltages in Power Systems". INTERNATIONAL REVIEW OF ELECTRICAL ENGINEERING-IREE 6 (5); 2666-2674 SEP-OCT 2011 **(J23, C26)**

C46. Malik MA, Kolb JF, Schoenbach KH.: "Streamers in water and along the insulator surface in a wire-cylinder gap". IEEE T PLASMA SCI 39 (11): 2626-2627 NOV 2011 **(J9)**

C47. Yagi I, Okada S, Matsumoto T, Wang D, Namihira T, Takaki K.: "Streamer propagation of nanosecond pulse discharge with various rise times". IEEE T PLASMA SCI 39 (11) Part 1; 2332-2233 NOV 2011 **(J8)**

C48. Beroual A, Coulibaly ML, Aitken O, Girodet A.: "Investigation on creeping discharges propagating over epoxy resin and glass insulators in the presence of different gases and mixtures". THE EUROPEAN PHYSICAL JOURNAL-APPLIED PHYSICS 56 (3), 30802 DEC 2011 **(J9)**

C49. Malik MA, Kolb JF, Sun Y, Schoenbach KH.: "Comparative study of NO removal in surface-plasma and volume-plasma reactors based on pulsed corona discharges". J HAZARD MATER 197; 220-228 DEC 2011 **(J9)**

C50. Kogut K, Kasprzyk K, Zboromirska-Wnukiewicz, B.: "The size effect influence on the electrical strength medium voltage insulators". PRZEGLAD ELEKTROTECHNICZNY 88 (11B); 138-141 2012 **(J19)**

C51. Malik MA, Xiao S, Schoenbach KH.: "Scaling of surface-plasma reactors with a significantly increased energy density for

NO conversion". J HAZARD MATER 209; 293-298 MAR 2012 **(J9)**

C52. Meng X, Chen C, Wang L: "Corona charge injection prior to sparkover in an inversed rod-plane gap under composite voltages". IEEE T POWER DELIVER 27 (3); 1442-1449 JUL 2012 **(J6**, **J11)**

C53. Zheng J, Xie L, Zhao Y, Wang L, Guan Z.: "A new multi-gap spark switch connected with frequency-dependent network for EHV overvoltage protection applications". IEEE T DIELECT EL IN 19 (4); 1369-1376 AUG 2012 **(J12)**

C54. Omidiora MA, Elkalashy NI, Lehtonen M, Abdel-Rahman MH.: "Modelling and evaluation of the lightning arc between a power line and a nearby tree". EUR T ELECTR POWER, 22 (6); 787-811 SEP 2012 **(C22)**

C55. Beroual A, Coulibaly ML, Aitken O, Girodet A.: "Effect of micro-fillers in polytetrafluoroethylene insulators on the characteristics of surface discharges in presence of $SF_6$, $CO_2$ and $SF_6$-$CO_2$ mixture". IET GENER TRANSM DIS 6 (10); 951-957 OCT 2012 **(J9)**

C56. Machidon D, Istrate M, Gusa M, Tibuliac S.: "Lighting protection zones estimation for a power station using the elliptic model". *International Conference and Exposition on Electrical and Power Engineering* (EPE), Lasi, Romania, OCT 2012, pp. 225-230 **(J15)**

C57. Kogut K, Kasprzyk K, Zboromirska-Wnukiewicz B.: "The size effect influence on the electrical strength medium voltage insulators". PRZEGLAD ELEKTROTECHNICZNY 88 (11B); 138-141 NOV 2012 **(J19)**

C58. Ravariu C.: "Residual doping concentration estimation in a separation by implanted oxygen film using current measurements". Source: IEE P-SCI MEAS TECH 7 (1); 1-6 JAN 2013 **(J16, J18)**

C59. Tewari SV, Reddy CS, Sharma A, Mittal KC.: "Effect on electron drift velocity and ionization coefficient along a gas-solid interface". *IEEE International Conference on Power, Energy and Control* (ICPEC), Dindigul, India, FEB 2013, 6527645, pp. 174-176 **(J9)**

C60. Hooshmand N, Rahimpour MR, Jahanmiri A, Taghvaei H, Shirazi MM.: "Hexadecane cracking in a hybrid catalytic pulsed dielectric barrier discharge plasma reactor". IND ENG CHEM RES 52 (12); 4443-4449 MAR 2013 **(J9)**

C61. Malik MA, Schoenbach KH.: "Sliding discharges in steam: effects of dielectric surface and hydrocarbon additives on hydrogen, oxygen and hydrogen peroxide generation". J PHYS D APPL PHYS 46 (14) Article Number: 145201 APR 2013 **(J9)**

C62. Zeng R, Zhuang C, Niu B, Yu ZQ, He JL.: "Measurement of transient electric fields in air gap discharge with an integrated electro-optic sensor". IEEE T PLASMA SCI 41 (4); 955-960 APR 2013 **(J8)**

C63. Deng JB, Mu HB, Zhang GJ, Matsuola S, Kumada A, Hidaka K.: "Residual charge distribution of surface leader discharge under positive impulse voltage". IEEE T PLASMA SCI 41 (4); 999-1004 APR 2013 **(J8)**

C64. Machidon D, Istrate M.: "A new model based on electro-geometrical theory for estimating the lightning protection zones". *8th International Symposium on Advanced Topics in Electrical Engineering* (ATEE), Bucharest, Romania, MAY 2013, DOI: 10.1109/ATEE.2013.6563470 **(J15)**

C65. Zhao X, Xie Y, He H, He J, Chen X, Cai H.: "Lightning performance assessment of 500kV transmission lines in Southern China". IEEE Power and Energy Society General Meeting (PES), Vancouver, Canada, JUL 2013, 6672765 **(J17, J20)**

C66. Settaouti, A.: "Monte Carlo simulation of positive corona discharge in $SF_6$". INTERNATIONAL JOURNAL OF ELECTRICAL POWER & ENERGY SYSTEMS 49; 349-353 JUL 2013 **(J8)**

C67. Li YF, Yang Q, Sima WX, Li JQ, Yuan T.: "Optimization of transmission-line route based on lightning incidence reported by the lightning location system". IEEE T POWER DELIVER 28 (3); 1460-1468 JUL 2013 **(J20)**

C68. Xie SJ, D'Alessandro F, Chen WJ, He JJ, He HX.: "Attachment processes and influencing factors in competition tests under switching impulse voltages". IEEE T PLASMA SCI 41 (7); 1773-1780 JUL 2013 **(J15, J17, J21)**

C69. Komuro A, Ono R, Oda T.: "Effects of pulse voltage rise rate on velocity, diameter and radical production of an atmospheric-pressure streamer discharge". PLASMA SOURCES SCI T 22 (4); Article number 045002 AUG 2013 **(J8)**

C70. Hamou N, Massinissa A, Youcef Z.: "Modeling and simulation of the effect of pressure on the corona discharge for wire–plane configuration". IEEE T DIELECT EL IN 20 (5); 1547-1553 OCT 2013 **(J13)**

C71. Kuczek T, Stosur M, Szewczyk M, Piasecki W, Steiger M.: "Investigation on new mitigation method for lightning overvoltages in high-voltage power substations". IET GENER TRANSM DIS 7 (10); 1055-1062 OCT 2013 **(J23, C28)**

C72. Wang L, Zhu B, Meng X, Mai H, Guan Z, Chen C.: "A study on streamer discharge characteristics along contamination insulator surface". *IEEE Conference on Electrical Insulation and Dielectric Phenomena* (CEIDP), Shenzhen, China, OCT 2013, pp. 967-970 **(J9, J16)**

C73. Zeng R, Chen S.: "The dynamic velocity of long positive streamers observed using a multi-frame ICCD camera in a 57 cm air gap". J PHYS D APPL PHYS 46 (38), Article number: 485201 DEC 2013 **(J8)**

C74. Abd-Elhady AM, Sabiha NA, Izzularab MA.: "Experimental evaluation of air-termination systems for wind turbine blades". ELECTR POW SYST RES 107; 133-143 FEB 2014 **(J1)**

C75. Wedaa H, Abdel-salam M, Ahmed A, Mizuno A.: "Two-dimensional modelling of dielectric barrier discharges using charge simulation technique-theory against experiment". IET SCI MEAS TECHNOL, MAR 2014 **(J9)**

C76. Becerra M.: "On the estimation of the charge of positive streamers propagating in air". IEEE T DIELECT EL IN 21 (2); 627-634 APR 2014 **(J9)**

C77. Beroual A, Coulibaly ML, Girodet A, Aitken O.: "Relationship between the fractal dimension of creeping discharges propagating at solid/gas interfaces and the characteristics parameters of interfaces". INTERNATIONAL REVIEW OF ELECTRICAL ENGINEERING 9 (2); 460-465 APR 2014 **(J9)**

C78. Warne LK, Jorgenson RE, Kunhardt EE.: "Criterion for spark-breakdown in non-uniform fields". J APPL PHYS, 115 (14), 143303 APR 2014 **(J8)**

C79. Sima W, Li Y, Rakov VA, Yang Q, Yuan T, Yang M.: "An analytical method for estimation of lightning performance of transmission lines based on a leader progression model". IEEE T ELECTROMAGN C, APR 2014 **(J26, J27)**

C80. Sadaoui F, Beroual A.: "AC creeping discharges propagating over solid-gas interfaces". IET SCI MEAS TECHNOL, JUN 2014 **(J9)**

C81. Khodja F, Younes M, Laouer M, Kherfane RL, Kherfane N.: "Study of the effect of the initiation voltage amplitude and the

nature of the insulating materials on the evolution of streamers by neural networks". INTERNATIONAL JOURNAL OF SYSTEM ASSURANCE ENGINEERING AND MANAGEMENT, JUL 2014 **(J9)**

**Sum of the times cited excluding self-citations: 262**

| **I** | **J1** | **J2** | **J4** | **J5** | **J6** | **J7** | **J8** | **J9** | **J10** | **J11** | **J12** | **J13** | **J14** | **J15** | **J16** | **J17** | **J18** | **J19** | **J20** | **J21** | **J22** | **J23** | **J24** | **J26** | **J27** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 15 | 2 | 2 | 3 | 5 | 3 | 45 | 67 | 11 | 1 | 5 | 13 | 3 | 4 | 8 | 5 | 1 | 3 | 7 | 5 | 3 | 6 | 1 | 1 | 2 |

| **C1** | **C2** | **C4** | **C8** | **C9** | **C12** | **C16** | **C17** | **C18** | **C19** | **C20** | **C22** | **C26** | **C28** | **C35** | **C40** | **C41** | **C43** | **C49** | **C51** |
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| 1 | 1 | 1 | 1 | 4 | 6 | 1 | 2 | 5 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 1 |

August 2014

## 11. Epitome of published work

### I. PhD Thesis

**"Influence of humidity and of other parameters on the breakdown mechanism of non-uniform gaps in atmospheric air". Aristotle University of Thessaloniki, 1995**

The breakdown mechanism of short and medium length rod-plane gaps is investigated by considering the effects of the wavefront of the applied positive impulse voltage (wavetail ~ 2.5 ms), gap length, geometry of the tip of the rod and, especially, absolute humidity on pre-discharges and breakdown. First and second corona inception probability distributions and breakdown probability distributions were obtained by monitoring of the electric field at the grounded plane. The statistical distributions of the first and second corona inception times, thus also of the dark period, as well as of the time to breakdown were found. Breakdown occurs either through a streamer-dominated breakdown mechanism or through one involving the development of a small leader; second corona predesignates which mechanism will take place. The dependence of the first and second corona characteristics, thus also of the final stages of the discharge at breakdown, upon absolute humidity is thoroughly discussed. The effect of absolute humidity on breakdown depends upon the extent of the gap bridged by the leader. Humidity correction factors for the breakdown voltage were found to vary with the gap configuration and the wavefront of the applied impulse voltage. There is a need for revision of the relevant IEC Standard concerning the effects of absolute humidity on the breakdown voltage of air gaps relatively short in length under impulse voltages.

### II. Publications in Scientific Journals

**J1.** **Mikropoulos, P. N., and Stassinopoulos, C. A.: "Influence of humidity on the breakdown mechanism of medium length rod-plane gaps stressed by positive impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1994, 141, (5), pp. 407-417** [www], [pdf]

To better understand the influence of atmospheric humidity on the breakdown mechanism of medium length rod-plane gaps when stressed by positive impulse voltages, emphasis was given to the initial prebreakdown phenomena (the first and second coronas) as well as the dark period. The salient events have been measured and assessed, especially the variation of their statistical distribution. Results were also taken and assessed to determine the influence of humidity on the breakdown probability curves, on the 50% breakdown voltages and on the distribution of the times to breakdown. During this investigation the main parameters, in addition to the humidity, were the gap length, the geometry of the end of the rod and the front duration of the impulse voltage. Humidity was found to have a great influence on the breakdown mechanism, especially its streamer region. It influences not only the 50% breakdown voltage but also its standard deviation. It was also found to cause changes in the shape of the U-curves. The necessary correction for humidity was found to vary considerably with the front duration of the applied impulse.

**J2.** **Gourgoulis, D. E., Mikropoulos, P. N., and Stassinopoulos, C. A.: "Sparkover voltage of sphere gaps under standard lightning and switching impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1996, 143 (3), pp. 187-194** [www], [pdf]

The influence of impulse waveshape, gap spacing and of humidity on the sparkover voltage of sphere gaps consisting of 25 cm diameter spheres has been studied for both polarities under standard waveshapes of 1.2/50 μs and 250/2500 μs. Results are compared with the values proposed by the IEC standard and an attempt to explain the breakdown mechanism and especially how it is influenced both by humidity and the waveshape has been made. Further suggestions are given concerning their use as calibrating gaps, especially under switching impulses. Also, under certain conditions, the inclusion in the calibrating gaps of 15 cm gaps is proposed.

**J3.** **Gourgoulis, D. E., Mikropoulos, P. N., and Stassinopoulos, C. A.: "On the corona inception in medium length positive rod - plane gaps under impulse voltages with long wavetails". *Facta Universitatis, Series: Electronics and Energetics*, 1997, 10 (1), pp. 91-105** [www], [pdf]

To understand better the breakdown mechanism in medium length rod-plane gaps when stressed by positive impulse voltages with long wavetails, emphasis was given to the initial pre-breakdown phenomena namely the first and second coronas. The salient events related to these phenomena have been measured and assessed and especially the variation of their statistical distribution. During this investigation the main parameters, were the gap length, the geometry of the end of the rod and the front duration of the impulse voltage. Emphasis was given to the appraisal of the extent of the influence of each parameter relatively to the variations of the others since these parameters act interactively.

**J4.** **Gourgoulis, D. E., Mikropoulos, P. N., and Stassinopoulos, C. A.: "Analysis of sphere - rod gaps under standard lightning and switching impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1997, 144 (1), pp.11-16** [www], [pdf]

The relative low cost of sphere–rod gaps compared to sphere gaps makes it worthwhile to study the breakdown mechanisms of the former, if only to find whether they could be used for calibrating or measuring purposes. Having this in mind, the influence of impulse shape, gap spacing and humidity on the sparkover voltage of sphere–rod gaps always in comparison with sphere gaps has been investigated under standard impulse waveshapes. It is found that breakdown is influenced by humidity, waveshape and especially by polarity. With these factors in view, the breakdown mechanism and the feasibility of using them as measuring substandards is discussed.

**J5.** **Gourgoulis, D. E., Mikropoulos, P. N., Stassinopoulos, C. A., and Yakinthos, C. G.: "Behaviour of positive conductor - rod gaps stressed by impulse voltages in atmospheric air". *IEE Proc.-Sci. Meas. Technol.*, 1997, 144 (5), pp. 209-214** [www], [pdf]

Results were obtained and evaluated so as to investigate the influence of various parameters on the breakdown mechanism of a 50cm positive conductor–rod gap under impulse voltages. For such a gap it was found that

several parameters affect its breakdown characteristics, notably humidity, waveshape of the applied impulse, diameter of the energised conductor and position of the earthed rod with respect to the conductor. Breakdown probability curves have been established, gap factors computed and their dependence on the aforementioned parameters investigated. Finally, the paths taken by the spark channel have been studied. Based on the information gained several suggestions concerning the breakdown mechanism are proposed.

**J6.** **Allen, N. L., Gourgoulis, D. E., Mikropoulos, P. N., Stassinopoulos, C. A., and Yakinthos, C. G.: "Effects of negative direct voltage pre-stressing on the breakdown of conductor-rod gaps under positive impulse voltages". *IEE Proc.-Sci. Meas. Technol.*, 1998, 145 (3), pp. 105-109** [www], [pdf]
The sparkover of a 50 cm conductor–rod gap under positive impulses is investigated when a pre-stressing negative direct voltage is applied to the rod. Under lightning impulses the pre-stress has a small effect on the breakdown voltage of the gap. For long-front impulses, a considerable increase in the dielectric strength of the gap can be observed. Several parameters affect this behaviour, like the value of the prestressing direct voltage, the diameter of the energised conductor, the position of the rod with regard to the conductor and the waveshape of the applied impulse.

**J7.** **Mikropoulos, P. N., and Stassinopoulos, C. A.: "Impulse breakdown of short rod-plane gaps and the influence of humidity". *IEE Proc.-Sci. Meas. Technol.*, 1998, 145 (4), pp. 141-146** [www], [pdf]
An attempt is made to assess the extent of influence of various parameters on the breakdown mechanism in short rod–plane gaps under positive impulses. Such parameters include front duration and peak value of the impulse voltage, gap length, profile of the rod and, in particular, absolute humidity. Depending on the above parameters, breakdown occurs either through a streamer-dominated breakdown mechanism or through one involving the development of a small leader. The second corona was found to predesignate which mechanism will take place, thus influencing the statistical behaviour of breakdown. Calculated humidity correction factors were found to be different from those proposed by IEC.

**J8.** **Allen, N. L., and Mikropoulos, P. N.: "Dynamics of streamer propagation in air". *J. Phys. D: Appl. Phys.*, 1999, 32 (8), pp. 913-919** [www], [pdf]
Results concerning the dynamics of streamer propagation in air under a uniform electric field are presented and discussed. Experiments were performed in a plane-parallel electrode arrangement with positive streamers initiated at a sharp point in the earthed anode. The basic properties of streamers are described in terms of the electric field required for a stable propagation and the associated propagation velocity. Critical parameters are the ambient electric field, the voltage used for streamer initiation and the distance of traverse. The present experiments permit the separation between the effects of the above parameters upon streamer advancement and propagation over the whole path up to the cathode. It is shown that an intrinsic propagation field with an associated velocity can be defined, which determine the propagation of streamers of a limiting, minimum energy. The propagation velocity is a power function of the electric field and, with the aid of an empirical equation, values can be expressed accurately in terms of these intrinsic streamer properties.

**J9.** **Allen, N. L., and Mikropoulos, P. N.: "Streamer propagation along insulating surfaces". *IEEE Trans. on Dielectrics and Electrical Insulation*, 1999, 6 (3), pp. 357-362** [www], [pdf]
Results concerning the propagation of streamers along insulating surfaces under uniform electric field are presented. The basic properties of streamers, namely the electric field required for a stable propagation and the propagation velocity, have been measured and compared with propagation in air alone as a reference. The results have shown that in the experimental arrangement used significant space charges due to streamer branching are absent, therefore the properties observed are considered as characteristic of a single streamer. Streamers propagate stably with an intrinsic propagation field and a characteristic velocity that depend on the nature of the insulating material. For electric fields higher than the minimum field required for a stable propagation, a streamer system propagates with a 'surface' and an 'air' component.

**J10.** **Allen, N. L., and Mikropoulos, P. N.: "Surface profile effect on streamer propagation and breakdown in air". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2001, 8 (5), pp. 812-817** [www], [pdf]
In a uniform field arrangement, under direct voltage, positive streamer propagation and breakdown are investigated along cylindrical insulators with different profiles, inserted perpendicularly between two parallel plane electrodes. The basic properties of streamer propagation arid breakdown, namely the electric field required for a stable propagation together with the associated velocity and the breakdown field together with time to breakdown, are measured as influenced by the pulse voltage amplitude used for the streamer initiation and by the insulator profile. It is shown that a strong relation between streamer propagation and breakdown exists, because the insulator profile exerts a similar influence on the breakdown and propagation fields. The effect of a shed on an insulating surface, forming an 'obstruction' to streamer progress, is to increase the stability for propagation and breakdown fields, and to reduce the propagation velocity at all applied fields compared with those in the case of a smooth insulator. Along the surface of a smooth insulator, a streamer system propagates with a 'surface' and an 'air' component; however, a shed on an insulating surface modifies this system, resulting in only one component reaching the cathode.

**J11.** **Gourgoulis, D. E., Mikropoulos, P. N., Stassinopoulos, C. A., and Yakinthos, C. G.: "Effects of negative DC pre-stressing on positive impulse breakdown characteristics of conductor-rod gaps". *IEE Proc.-Sci. Meas. Technol.*, 2005, 152, (4), pp. 155-160** [www], [pdf]
The positive impulse breakdown behaviour of conductor-rod gaps 50 cm in length is investigated while negative DC voltages pre-stress the gap. Breakdown voltage and time to breakdown variations are discussed in terms of the parameters influencing the discharge mechanism such as the gap geometry, the amplitude of the pre-stress negative DC voltage applied at the rod, the waveshape of the applied impulse voltage at the conductor and the variation of absolute humidity. It is shown that pre-stressing, by producing sufficient DC coronas at both

electrodes, results in a significant increase in the breakdown voltage. There is a threshold value of the pre-stress DC voltage above which the gap factor against breakdown may double its value. Both absolute humidity and pre-stressing affect, in a combined way, the dielectric strength of the gaps.

**J12.** **Mikropoulos, P. N., and Stassinopoulos, C. A.: "Impulse sparkover characteristics of sphere-rod gaps". *IEE Proc.-Sci. Meas. Technol.*, 2005, 152, (4), pp. 169-174** [www], [pdf]
The sparkover behaviour of sphere-rod gaps under standard impulse voltages is investigated by assessing the influence of gap spacing, impulse voltage waveshape and polarity, and atmospheric conditions on the distribution of the sparkover voltage. At sparkover the growth of streamers of both polarities can be estimated since a value of 2 MV/m is found to be characteristic for the average negative streamer gradient. The IEC atmospheric conditions correction is discussed and compared with a new optimised correction procedure. The feasibility of using the sphere-rod gap as substandard for measuring impulse voltages, replacing the conventional more expensive sphere gap, is examined.

**J13.** **Mikropoulos, P.N., Stassinopoulos, C.A. and Sarigiannidou, B.C.: "Positive streamer propagation and breakdown in air: the influence of humidity". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2008, 15 (2), pp. 416-425** [www], [pdf]
The influence of humidity on streamer propagation at conditions from the threshold for propagation to those for streamer-induced breakdown was investigated in a uniform field in air at atmospheric pressure. Experiments were carried out in a three electrode arrangement consisting of a 12 cm long parallel-plane gap, with an auxiliary needle in the earthed anode. Positive streamers were initiated by applying at the needle electrode a pulse voltage which varied in amplitude. These propagated towards the upper plane electrode which was stressed by a negative dc voltage. Under natural atmospheric conditions, propagation and breakdown probability curves were obtained for several values of absolute humidity in the range between 5 and 22 g/m$^3$. Thus, distributions of the electric field required for streamer propagation and breakdown were obtained and the associated velocity of propagation and time to breakdown were measured. Besides humidity, the amplitude of the voltage used for streamer initiation and the ambient electric field were considered as influencing parameters on streamer properties. Empirical equations are presented expressing the effects of the above parameters on the intrinsic streamer properties. A comparison with previous work in the literature is made and this leads to the conclusion that the influence of humidity on streamer propagation and breakdown can be placed in a sounder quantitative basis.

**J14.** **Lazaridis, L.A., and Mikropoulos, P.N.: "Flashover along cylindrical insulating surfaces in a non-uniform field under positive switching impulse voltages". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2008, 15 (3), pp. 694-700** [www], [pdf]
Results are presented concerning discharge development and breakdown in air and along cylindrical insulating surfaces in a 12 cm long rod-plane gap under positive switching impulse voltages. Discharge development and breakdown probability curves were obtained. The times taken for the discharge to cross the full gap and for breakdown were measured and the corresponding instantaneous voltages were calculated. The gap was overstressed so as to study the effect of the applied peak voltage on the discharge characteristics. In the presence of an insulating surface the discharge consists of a 'surface' and an 'air' component; the former hinders the development of the latter. At voltages causing 50% breakdown probability only the 'air' component traverses the full gap and breakdown occurs always in free air. For higher applied voltages the 'surface' component may become able to cross the full gap and breakdown may occur also along the insulating surface; under these conditions both the arrival of the discharge at the plane and breakdown occur at shorter times and at lower voltages than in air alone, depending on insulating surface material.

**J15.** **Mikropoulos, P.N., and Tsovilis, T.E.: "Striking distance and interception probability". *IEEE Trans. on Power Delivery*, 2008, 23 (3), pp. 1571-1580** [www], [pdf]
The relation between the striking distance and interception probability is experimentally investigated under standard lightning impulse voltages of both polarities. By using the rod-plane gap as a reference case, results are presented relating to the discharge interception probability of an earthed rod inserted in the gap. There is a critical separation distance between the stressed and earthed rods at which breakdown occurs either to the plane or to the earthed rod with the same probability. Besides the impulse voltage polarity, the length of the reference gap and the earthed rod height are considered as parameters influencing on interception probability. Results are discussed on the basis of the breakdown mechanism and electric field calculations. The striking distance is defined with the aid of an expression that takes into account, besides lightning peak current, the interception probability and the effects of lightning polarity and struck object height. The results introduce the design of lightning protection systems on the basis of lightning interception probability.

**J16.** **Mikropoulos, P.N.: "Streamer propagation along room-temperature-vulcanised silicon-rubber-coated cylindrical insulators". *IET Sci. Meas. Technol.*, 2008, 2 (4), pp. 187-195** [www], [pdf]
Results concerning streamer propagation along cylindrical insulators coated with room-temperature vulcanized silicon rubber coatings are presented. Experiments were carried out in a three-electrode arrangement consisting of a 12 cm long parallel-plane gap with an auxiliary needle in the earthed anode. Insulators could be inserted between the plane electrodes adjacent to them and almost in contact with the needle. Positive streamers were initiated by applying at the needle electrode a pulse voltage variable in amplitude and propagated over the insulators towards the upper plane electrode which was stressed by a negative DC voltage. The streamer propagation field at conditions from threshold up to the stable streamer propagation and the associated velocity were measured. The dependence of the streamer velocity on the electric field was investigated with the type of coating as parameter. Both the streamer propagation field and the associated velocity of propagation are higher, when a streamer propagates along the coated insulators, than the reference bare nylon insulator depending on

the coating employed. Streamers might be used as an effective probe for studying the surface dielectric behaviour of coated insulators hence also for evaluating the various coatings used to improve the contamination performance of outdoor high-voltage insulators.

**J17.** **Mikropoulos, P.N., and Tsovilis, T.E.: "Interception probability and shielding against lightning". *IEEE Trans. on Power Delivery*, 2009, 24 (2), pp. 863-873** [www], [pdf]
A comprehensive analysis on shielding against lightning is presented. For an air terminal, the design of its protection zone and collection volume is introduced on the basis of simple working relationships which take into account, besides lightning parameters and air terminal height, the interception probability and use as a reference the striking distance to earth surface. The analysis, based on lightning scale-model experimental results, includes a comparison with previously reported models and field data; a satisfactory agreement is found. Lightning incidence calculations have been performed on the basis of lightning interception probability; a close conformity between the actual and calculated number of lightning strikes exists. Both striking distance and interception radius and their statistical nature should be considered for an accurate description of lightning interception.

***As Associate Professor***

**J18.** **Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: "Lightning impulse behaviour of short rod-plane gaps with a dielectric-covered rod". *IET Sci. Meas. Technol.*, 2010, 4 (2), pp. 53-62** [www], [pdf]
The breakdown mechanism of dielectric-covered rod/plane air gaps under positive lightning impulse voltages is investigated. Several gap lengths, varying between 2.5 and 15 cm, were employed and the simple air gaps were regarded as reference. The basic characteristics of coronas, namely inception time and voltage, were measured at applied voltages just sufficient for their inception up to voltages causing breakdown. Multiple level tests were conducted; thus, corona inception and breakdown probability distributions were obtained and time to breakdown was measured at several voltage levels. Interpretation of the results was made based on oscillograms of the electric field strength at the earthed plane, which was monitored through a capacitive probe, geometric field calculations and still photographs of the discharge at breakdown. In the dielectric-covered rod/plane gaps, breakdown occurs at higher applied voltages as a result of increased both corona inception voltages and discharge path. The development of the discharge depends on the electric field distribution as modified by both space and surface charges associated with coronas preceding breakdown. Surface charge accumulation may affect the discharge path at breakdown.

**J19.** **Lazaridis L.A., and Mikropoulos P.N.: "Positive lightning impulse discharges along cylindrical insulating surfaces bridging a short rod-plane gap". *IET Sci. Meas. Technol.*, 2010, 4 (2), pp. 63-75** [www], [pdf]
The salient characteristics of the predischarge phenomena and flashover along cylindrical insulating surfaces bridging a short rod-plane gap under positive lightning impulse voltages were measured in a wide range of applied peak voltages. Materials used in the investigation were polytetrafluoroethylene (PTFE), silicone-rubber, nylon and glazed porcelain; the case of air alone was regarded as reference. Corona inception is favoured by the presence of an insulating surface, this being more evident for materials of high permittivity and for initial than secondary corona. At relatively high applied voltages, the initial corona characteristics are directly related to the field enhancement at the tip of the stressed electrode. However, near threshold inception conditions there is a marked reduction of the inception field with material permittivity; an assisting mechanism of initiatory electron production was put forward to explain this behaviour. Initial corona streamers require higher applied voltages to arrive at the earthed plane when propagating along an insulating surface than in air alone. Flashover, closely related to secondary corona characteristics, is always preceded by continuous corona growth, occurring mainly in free air away from the insulating surface because of possible positive surface charge deposition by the initial corona; the latter is characteristic for polymeric insulating surfaces. There is a reduction of the dielectric strength of the gap in the presence of an insulating surface, more pronounced for higher material permittivity, related to the facilitating action of the field enhancement close to the rod tip on continuous corona growth preceding flashover.

**J20.** **Mikropoulos P.N., and Tsovilis T.E.: "Estimation of lightning incidence to overhead transmission lines". *IEEE Trans. on Power Delivery*, 2010, 25 (3), pp. 1855-1865** [www], [pdf]
General expressions for the estimation of lightning incidence to overhead transmission lines on the basis of electrogeometric and generic models are introduced, which consider, besides transmission-line geometry, lightning crest current distribution and, based on the recently proposed statistical model, interception probability distribution. An application to typical 115 kV up to 765 kV and large scale 500 kV and UHV overhead transmission lines is performed and the computed results, varying significantly among lightning attachment models, are validated through comparisons with field data from literature; the IEEE Std 1243 overestimates significantly lightning incidence to shield wires of large scale transmission lines. The expected annual number of lightning strikes to shield wires of transmission lines depends on lightning crest current distribution; this dependence, easily quantified with the aid of the introduced general expressions, is not considered by the relevant IEEE standard. Lightning incidence results are discussed in the context of the backflashover rate of overhead transmission lines.

**J21.** **Mikropoulos P.N., and Tsovilis T.E.: "Interception probability and proximity effects: Implications in shielding design against lightning". *IEEE Trans. on Power Delivery*, 2010, 25 (3), pp. 1940-1951** [www], [pdf]
The effects of a neighboring object on the interception probability distribution of an air terminal are investigated through scale model experiments. The discharge interception probability of an earthed rod is influenced by the presence of a neighboring shorter one when both inserted in a rod-plane gap. This depends on the polarity of the impulse voltage, the height of the earthed rods and their displacement with respect to the energized rod. The

experimental results are interpreted in terms of the breakdown mechanism and electric field calculations; their possible extension to shielding design is discussed. Proximity effects may result in a reduction in the striking distance and interception radius of an air terminal, especially at the lower interception probabilities. A new approach for shielding design is introduced, which considers, besides lightning parameters and height of the prospective struck objects, interception probability and proximity effects.

**J22.** **Lazaridis L.A., and Mikropoulos P.N.: "Negative impulse flashover along cylindrical insulating surfaces bridging a short rod-plane gap under variable humidity". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2010, 17 (5), pp. 1585-1591** [www], [pdf]
Negative impulse flashover along insulating surfaces bridging a short rod-plane gap is investigated under variable humidity. The specimens, cylindrical in shape and with a smooth surface, were made of PTFE, silicone-rubber, nylon and glazed porcelain and were bridging the gap, which was stressed by standard lightning and switching impulse voltages. Breakdown probability distributions were obtained and the breakdown voltage and time to breakdown were measured. The gap was overstressed by applying voltages higher than that causing 100% breakdown so as to study the effects of the applied peak voltage on breakdown characteristics. When breakdown occurs over an insulating surface the breakdown voltage is significantly lower compared to that obtained for air alone, especially at lower breakdown probabilities and under switching impulse voltages. It is also lower for lightning than switching impulse voltages, this being less marked with increasing material permittivity. Breakdown is closely related to negative corona growth. The effect of absolute humidity on breakdown voltage is minimal. The IEC atmospheric conditions correction procedure yields satisfactory results when breakdown occurs both in air alone and along an insulating surface.

**J23.** **Mikropoulos P.N., and Tsovilis T.E.: "Lightning attachment models and maximum shielding failure current of overhead transmission lines: Implications in insulation coordination of substations". *IET Generation, Transmission and Distribution*, 2010, 4 (12), pp. 1299-1313** [www], [pdf]
The maximum shielding failure current of overhead transmission lines is an important parameter in evaluating the shielding performance of the lines and in insulation coordination of substations. General expressions for the estimation of the maximum shielding failure current of transmission lines, derived by employing several lightning attachment models in shielding analysis, are presented. An application to typical 110 kV up to 1150 kV overhead transmission lines shows that there is a great variability in maximum shielding failure current among lightning attachment models. The importance of maximum shielding failure current in insulation coordination of substations is demonstrated with the aid of alternative transients program-electromagnetic transients program (ATP-EMTP) simulations. The computed overvoltages impinging on 150 and 400 kV gas insulated system (GIS) substations because of shielding failure of the incoming overhead transmission lines, being dependent upon shielding failure current, vary with the lightning attachment model employed in shielding analysis of the lines. Implementation of the electrogeometric model adopted by IEEE Std 1243:1997 in shielding analysis imposes high requirements on protection of the substations against incoming shielding failure surges.

**J24.** **Lazaridis L.A., and Mikropoulos P.N.: "Positive impulse flashover along smooth cylindrical insulating surfaces under variable humidity". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2011, 18 (3), pp. 745-754** [www], [pdf]
Positive impulse flashover along smooth cylindrical insulating surfaces bridging a short rod-plane gap under standard lightning and switching impulse voltages is investigated under variable absolute humidity and by regarding the case of air alone as reference. Flashover is closely related to predischarge phenomena, specifically secondary corona under lightning impulses and corona streamers arrival at the earthed plane under switching impulse voltages. Under lightning impulses the dielectric strength of the gap is highest for air alone and decreases with material permittivity; the opposite is true, although less marked, under switching impulse voltages. Flashover voltage increases with absolute humidity, this being more pronounced for switching than lightning impulse voltages. The inhibitory effect of humidity on flashover, mainly determined by the trajectory of the spark channel with respect to the insulating surface, is similar to that observed in air alone where flashover occurs away from the insulating surface but reduced where the discharge develops close to the insulating surface. For insulating arrangements where at flashover the spark channel adheres to the insulating surface the IEC 60060-1:1989 atmospheric conditions correction procedure should be optimized by considering a reduced humidity correction factor.

**J25.** **Mavroidis P.N., Mikropoulos P.N., and Stassinopoulos C.A.: "Impulse behavior of dielectric-covered rod-plane air gaps". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2012, 19 (2), pp. 632-640** [www], [pdf]
The impulse behavior of composite short rod-plane air gaps with a dielectric-covered rod under positive lightning and switching impulse voltages is investigated, by monitoring the electric field strength at the earthed plane, by still photographs of corona discharges and through electric field computations. Experiments were performed in normal laboratory air at pressure around 0.1 MPa, temperatures in the range 19 to 28 $^{o}$C and absolute and relative humidity varied naturally between 11-21 g/m$^{3}$ and 60-90%, respectively. Breakdown probability distributions were obtained for composite gaps with a dielectric cover made of either PTFE or epoxy resin and for simple air gaps with a bare rod. Also, basic characteristic parameters of coronas preceding breakdown in composite gaps, namely initial corona in the vicinity of the covering tip, surface coronas emerging along the dielectric cover and developing mainly in air, and secondary corona in the vicinity of the cover upper end, were measured. Surface corona development is greatly affected by initial corona growth and facilitates secondary corona inception. Breakdown, occurring at higher voltages for composite gaps, is closely related with the secondary corona inception; a similar dependence upon impulse waveshape and cover material was seen to exist. At breakdown, the spark channel bridges the gap that includes the dielectric cover length. The spark channel develops either along the cover surface or partly or solely in free air, being affected by surface corona development.

**J26.** **Mikropoulos P.N., and Tsovilis T.E.: "Estimation of the shielding performance of overhead transmission lines: The effects of lightning attachment model and lightning crest current distribution". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2012, 19 (6), pp. 2155-2164** [www], [pdf]
Shielding failure of overhead transmission lines is a major cause of transmission system outages, affecting reliability of power supply and resulting in economic losses. In this study the shielding performance of overhead transmission lines is evaluated with the aid of general expressions, derived by implementing in shielding analysis different categories of lightning attachment models. Thus, the effects of lightning attachment model, transmission line parameters and lightning crest current distribution on shielding failure rate of overhead transmission lines have been quantified. Alternative approaches to that proposed by IEEE Std 1243 for assessing the shielding performance of transmission lines, including computer simulations of lightning attachment, are evaluated. Shielding failure rate results are discussed and compared with field data reported in literature. For typical overhead transmission lines, an upper limit of the estimated shielding failure rate is 0.4% of the rate of lightning strokes to the line. More and reliable field data is needed in order to evaluate lightning attachment models with respect to the lightning performance of overhead transmission lines.

**J27.** **Mikropoulos P.N., and Tsovilis T.E.: "Statistical method for the evaluation of the lightning performance of overhead distribution lines". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2013, 20 (1), pp. 202-211** [www], [pdf]
Lightning is a major cause of distribution line outages affecting reliability of power supply thus, consequently, resulting in economic losses. The lightning performance of overhead distribution lines is associated with line insulation flashover due to direct and nearby lightning strokes. The present paper introduces a statistical method for the estimation of the flashover rate of overhead distribution lines. The proposed method, implementing a recently introduced statistical lightning attachment model and the simplified coupling model suggested by the IEEE Std. 1410:2011, yields a range for the expected flashover rate of distribution lines associated with lightning interception probability distribution of the line conductors. It also provides the means to easily quantify the effects of line parameters, soil resistivity, shielding of nearby objects and lightning crest current distribution on lightning performance of distribution lines. Results of the statistical method, discussed and compared with that obtained by the IEEE Std. 1410:2011, are in close consistency with field data.

**J28.** **Datsios Z.G, Mikropoulos P.N., and Tsovilis T.E.: "Estimation of the minimum shielding failure flashover current for first and subsequent lightning strokes to overhead transmission lines". *Electric Power System Research*, 2014, Vol. 113 (SI), pp. 141-150** [www], [pdf]
ATP-EMTP simulations are performed to estimate the minimum shielding failure current causing flashover in overhead transmission lines with operating voltage in the range of 66 kV up to 735 kV. This critical current, affecting shielding failure flashover rate, is of great importance for assessing the insulation coordination of overhead transmission lines and the connected substations. The minimum shielding failure current causing flashover of line insulation is highly dependent upon insulator string flashover modelling and, also, markedly higher than that calculated according to the relevant IEEE Std 1243-1997simplified expression. A modification of the latter is suggested by using multiplication factors of 1.5 and1.65 for first and subsequent lightning strokes, respectively, so as to account for the increased dielectric strength of line insulator strings under non-standard lightning overvoltage surges. Alternatively, the critical currents can be respectively estimated by using average negative breakdown gradients per unit length of insulator string of 680 kV/m and 750 kV/m. The shielding failure flashover rate of the overhead transmission lines, being greatly influenced by insulator string flashover modelling, is lower than that obtained based on the critical current according to IEEE Std 1243-1997.

**J29.** **Mikropoulos P.N., Tsovilis T.E. and Koutoula S.G.: "Lightning performance of distribution transformer feeding GSM base station". *IEEE Trans. on Power Delivery*, 2014, DOI:10.1109/TPWRD.2014.2335253 (early access)** [www], [pdf]
Data on unscheduled electric service interruptions in an extended distribution network (20/0.4 kV) were analyzed in order to examine the causes contributing to distribution substation failures. A distribution substation feeding a Global System for Mobile Communications base station experienced the highest service interruption rate due to transformer sustained failures, the vast majority of which were categorized as lightning related. Thus, with the aid of detailed Alternate Transients Program–Electromagnetic Transients Program simulations, an investigation on the overvoltages surges impinging on the distribution transformer due to direct lightning strokes to the connected MV overhead line and to the nearby telecommunication tower has been made. Transformer failures are caused solely by fast-front overvoltages exceeding the basic insulation level of the LV side of the transformer. This is substantiated by the good agreement between estimated and reported transformer failure rates. The safe operation of the distribution transformer necessitates the installation of surge protective devices at its low-voltage terminals, also overcoming the need for extremely low values of telecommunication tower grounding resistance. Additional line surge arresters should be installed at the penultimate wood pole of the connected overhead line which, besides improving the lightning performance of the transformer, significantly increases the reliability of the distribution substation.

**J30.** **Mikropoulos P.N., and Zagkanas V.N.: "Threshold inception conditions for positive DC corona in the coaxial cylindrical electrode arrangement under variable atmospheric conditions". *IEEE Trans. on Dielectrics and Electrical Insulation*, 2014, in press** [www], [pdf]
The conditions for threshold inception of positive DC corona in the coaxial cylindrical electrode arrangement are investigated. The establishment of the self-sustained corona discharge in glow or streamer form, as influenced by conductor radius and atmospheric conditions, is evaluated through detailed computations that consider space charge field effects on avalanche growth. The salient corona characteristics at threshold inception are assessed and discussed through comparisons with literature experimental data. In a wide range of inner conductor radius and atmospheric conditions corona initiates in streamer form when a critical avalanche number per unit length of

about $10^8$ cm-1 is attained. Accurate formulation of the critical field strength required to sustain ionization allowed for the derivation of approximate expressions accounting well for the interactive effects of conductor radius and atmospheric conditions on the corona inception field strength in both glow and streamer regimes.

## III. Publications in Conference Proceedings

**C1. Stassinopoulos, C. A., Mikropoulos, P. N., and Bagavos, C. J.: "On the influence of humidity on positive impulse breakdown of medium rod-plane gaps". *10th International Conference on Gas Discharges and their Applications*, Swansea, 1992, Vol. 2, pp. 596-599**

The effects of absolute humidity on the breakdown mechanism of medium length rod-plane gaps (75 & 100cm) under positive impulse voltages are investigated. In addition to absolute humidity, the geometry of the tip of the rod and the front duration of the applied impulse voltage (wavetail duration ~2 ms) were considered as influencing parameters. Discharge activity was recorded through oscillograms of the electric field strength at the earthed plane. The first corona inception time and voltage were measured. Breakdown probability distributions were obtained; thus, the time and voltage to breakdown were found. The relation between first corona and breakdown, as influenced by absolute humidity, is discussed. [pdf]

**C2. Stassinopoulos, C. A., Mikropoulos, P. N., and Bagavos, C. J.: "Positive impulse humidity correction factor for medium rod-plane gaps". *10th International Conference on Gas Discharges and their Applications*, Swansea, 1992, Vol. 2, pp. 600-603** [pdf]

This paper investigates the influence of the wavefront duration of the applied positive impulse voltage on the humidity correction factor of medium length rod-plane gaps (75 & 100cm) differing in rod tip geometry. The relation between the 50% breakdown voltage and humidity was found to be linear in many cases; linear regression correlation factors and a humidity correction factors were calculated. The humidity correction factor was found to vary with the gap length, tip of the rod and the front duration of the applied impulse voltage (wavetail duration ~2 ms). This behavior is discussed based on the effects of humidity on discharge initiation and development.

**C3. Mikropoulos, P. N., and Stassinopoulos, C. A.: "Humidity influences on the breakdown of rod-plane gaps under positive impulses in atmospheric air". *Workshop on Contemporary Problems in Power Engineering*, Thessaloniki, 1995, pp. 337-343** [pdf]

The purpose of this paper is the consideration of the influence of the gap configuration and of the wavefront duration of the applied impulse voltage on the 50% breakdown voltage and on the humidity correction factor for rod-plane gaps with length varying from 25 to 100 cm under positive impulse voltages. The relation between the 50% breakdown voltage and the humidity and the humidity correction factor were both found to vary with the gap length, the tip of the rod and the front duration of the applied impulse. Thus, linear regression correlation factors and a humidity correction factors were calculated; it is proposed that a connection exists between them. It was found that the tip of the rod affects the humidity correction factor in an opposite way than it does the 50% breakdown voltage. Furthermore, it was shown that the influence of the tip of the rod on the humidity correction factor is stronger for shorter gaps, on the contrary for the 50% breakdown voltage it is stronger for longer gaps.

**C4. Gourgoulis, D. E., Mikropoulos, P. N., and Stassinopoulos, C. A.: "On the breakdown parameters of medium rod - plane gaps stressed by impulse voltages with long wavetails". *31st Universities Power Engineering Conference*, Heraklion, 1996, Vol. 3, pp. 744-747** [pdf]

The purpose of the present study is the investigation of the effect of the absolute humidity on the breakdown mechanism of medium length rod - plane gaps (75 & 100 cm) under positive impulse voltages with long wavetails in atmospheric air. Besides the humidity, the geometry of the end of the rod and the front duration of the applied impulse were taken as parameters. Humidity was found to have a great influence on the breakdown mechanism and especially to its streamer part. It influences not only the 50% breakdown voltage, for which the necessary correction for humidity was found to vary considerably with the front duration of the applied impulse, but the whole of the breakdown probability curve.

**C5. Mikropoulos, P. N., and Stassinopoulos, C. A.: "Humidity effect on the properties of coronas preceding breakdown in short positive rod - plane gaps". *33rd Universities Power Engineering Conference*, Edinburgh, 1998, paper No. 169, pages 4** [pdf]

In short rod - plane gaps under positive impulse voltages the properties of phenomena occurring during the early stages of the discharge, namely the first and second coronas, have been investigated. Measurements are reported of the variation of their inception time and voltage as a function of the wavefront duration, the gap length, the shape of the end of the rod and the absolute humidity. For purposes of further elucidation, the gaps were divided into two categories depending on to whether second corona emerged during the front or the tail of the applied impulse, and the properties of the coronas into two groups, on the basis of whether breakdown occurred or not. Special interest was given to the influence of the absolute humidity as the experiments and the analysis that followed showed that humidity acts interactively with the other discharge parameters. As a result, humidity exerts sometimes inhibitory sometimes facilitating action on the inception of the first corona whereas on the inception of the second its action is always inhibitory.

**C6. Allen, N. L., and Mikropoulos, P. N.: "On streamer propagation along insulating surfaces". CIGRE, 33-98, (WG-04/07) 11 IWD, 1998** [pdf]

Results concerning the propagation of streamers along insulating surfaces under uniform electric field are presented. The basic properties of streamers, namely the electric field required for a stable propagation and the propagation velocity, were measured in the absence of significant space charge. Streamers propagate stably with an intrinsic propagation field and a characteristic velocity that depend on the insulating material. For electric fields greater than the minimum field required for a stable propagation, a streamer system propagates with a

'surface' and a 'pseudo-air' component.
*[Precursor of J9]*

**C7.** **Allen, N. L., and Mikropoulos, P. N.: "Streamer properties in air and in the presence of insulators". *10th International Conference Electrostatics 1999*, Cambridge, Institute of Physics, pp. 49-52** [pdf]
Under uniform electric field, the propagation of a single streamer along insulating surfaces was studied. The dynamics of streamer growth were investigated as influenced by the amplitude of the voltage, and therefore energy, used for initiation and the nature of the insulating material; in this case fibreglass and resin. It is shown that the stable propagation of the streamer can be described in terms of an intrinsic propagation field together with an associated velocity. These properties are characteristic of the medium employed and were used to formulate the relation between the propagation velocity and electric field. Along an insulating surface a streamer system propagates with a surface and an air component.

**C8.** **Allen, N. L., and Mikropoulos, P. N.: "Influence of insulator profile on streamer propagation". *11th International Symposium on High Voltage Engineering, London*, 1999, paper No. 3.15, pages 4** [www], [pdf]
In a uniform electric field the propagation of a positive single streamer along insulators made of PTFE has been studied. The basic properties of streamer, namely the minimum electric field required for stable propagation together with the associated propagation velocity, and the dynamics of streamer growth were investigated. These streamer properties are influenced by the amplitude of the voltage, and therefore energy, used for initiation and by the profile of the insulator. The streamer growth was studied for applied electric fields greater than the minimum required for stable propagation. Along a smooth insulating surface a streamer system propagates with a 'surface' and an 'air' component, however, a step on the surface results, depending on its position, in a modification of this system.

**C9.** **Allen, N. L., and Mikropoulos, P. N.: "Profile effect on surface flashover in a uniform field". *11th International Symposium on High Voltage Engineering, London*, 1999, paper No. 3.216, pages 4** [www], [pdf]
**[*ISH '99 Hydro-Quebec Prize Paper Award*]**
Flashover results on insulator specimens with different profiles in a uniform electric field in air are presented. Under direct voltages, positive streamers, propagating along cylindrical insulators, inserted perpendicularly between two parallel plane electrodes, result in breakdown. Breakdown in air alone is studied as a reference. Breakdown fields and times to breakdown are measured as influenced by the pulse voltage amplitude used for the streamer initiation, and by the insulator profile. A higher electric field is required for breakdown along an insulating surface rather than in air. It is shown that a strong relation between the discharge propagation and breakdown exists; the insulator profile exerts similar influence on the breakdown field as on the propagation field.

**C10.** **Mikropoulos, P. N., Stassinopoulos, C. A., and Yakinthos C. G.: "Negative DC pre-stressing on conductor-rod gaps under positive impulse voltages". *X International Symposium on Gaseous Dielectrics*, Athens, 2004, paper No. 51, pages 6** [www], [pdf]
The influence of the superimposition of positive impulses on negative DC pre-stressed conductor-rod gaps with spacing of 50 cm is investigated. Previous experiments have shown that when a conductor of 2 cm in diameter is used a marked increase in the dielectric strength of the gap is observed when negative DC voltages between 100 kV and 125 kV in value are applied at the rod; this is not the case for a 3 cm conductor. This paper provides new data concerning the above phenomenon; by applying higher values of pre-stressing voltage a similar behaviour as with the 2 cm conductor is observed for the 3 cm conductor. The discharge mechanism is discussed taking into consideration parameters affecting the above behaviour, such as the value of the pre-stressing DC voltage, the waveshape of the applied impulse voltage and the variation of absolute humidity.
*[Precursor of J11]*

**C11.** **Mikropoulos, P. N., Stassinopoulos, C. A., Katarachias, I., and Tsetoglou, A.: "Sparkover characteristics of sphere-rod gaps under standard impulse voltages". *WSEAS Transactions on Circuits and Systems*, 2004, Vol. 3, (5), pp. 1197-1200** [www], [pdf]
The sparkover behaviour of sphere-rod gaps under standard impulse voltages is investigated by assessing the influence of gap spacing, voltage waveshape and polarity, and atmospheric conditions on the distribution of the sparkover voltage. A new correction procedure for atmospheric conditions is introduced and the related IEC standard is discussed. The feasibility of using the sphere-rod gap as measuring substandard, replacing the conventional more expensive sphere gap, is examined.
*[Precursor of J12]*

**C12.** **Mikropoulos, P. N., and Stassinopoulos, C. A.: "Atmospheric correction procedure in rod-plane gaps up to 1 m in length". *39th Universities Power Engineering Conference*, Bristol, 2004, Vol. 1, pp. 207-210** [pdf]
The influence of atmospheric conditions on the dielectric strength of external insulation is a complicated matter. Investigations carried out resulted in a correction procedure for atmospheric conditions that is currently adopted by the IEC standard 60060-1/1989. Despite its widespread applicability, many of the factors employed in this standard are still under consideration and several authors have argued about its validity especially on short air gaps. This paper presents data concerning the breakdown characteristics of rod-plane gaps under positive impulse voltages. Emphasis is given on the influence of atmospheric conditions, the effect of gap spacing and the wavefront duration of the applied impulse voltages. Empirical expressions relating to these parameters are presented. An optimised atmospheric correction procedure is introduced which employs an iterative concurrent correction for both air density and humidity estimating more accurately than the IEC procedure the influence of atmospheric conditions.

**C13.** **Mikropoulos P.N., Stassinopoulos C.A., and Yakinthos C.G.: "Αύξηση της δυνατότητας μεταφοράς ενέργειας σε υψηλές τάσεις μέσω της συμπίεσης των διακένων". *1ο Πανελλήνιο Συνέδριο Διπλ. Μηχανολόγων – Ηλεκτρολόγων*, Αθήνα, 2005, σελ. 6** [pdf]
This paper summarises the findings of a literature review on the effects of pre-stressing upon the dielectric strength of non-uniform air gaps. It also presents experimental results referring to the breakdown mechanism of a 50 cm conductor-rod gap under positive impulse voltages as influenced by negative DC pre-stressing. Pre-stressing, by producing sufficient DC coronas at both electrodes, results in a significant increase in the breakdown voltage. There is a threshold value of the pre-stress DC voltage above which the gap factor against breakdown may increase up to 100%. (In Greek).

**C14.** **Mikropoulos, P. N., Sarigiannidou, B. C., Stassinopoulos, C. A., and Tsakiridis, C.: "Influence of humidity on positive streamer propagation and breakdown in a uniform field in air". *40th Universities Power Engineering Conference*, Cork, 2005, Vol. 2, pp. 803-807** [pdf]
Results are presented concerning the influence of humidity on streamer propagation and breakdown in a uniform field in air at atmospheric pressure with atmospheric conditions varying naturally. Experiments were carried out in a three electrode arrangement consisting of a parallel-plane gap, 12 cm spacing, and a needle in the earthed anode. Positive streamers are initiated by applying a pulse voltage, varying in amplitude, at the needle electrode and propagate towards the upper plane electrode which is stressed by negative DC voltage. Streamer properties investigated are the electric field required for stable streamer propagation and the propagation velocity under field values sustaining stable streamer propagation and under overfields. Time to breakdown and the corresponding field are also measured. Propagation and breakdown probability curves are obtained for several values of absolute humidity in the range between 5.5 and 18 g/m$^3$. It is shown that increasing humidity results in higher field required for streamer propagation and breakdown and in greater propagation velocity. Time to breakdown decreases with increasing humidity.
*[Precursor of J14]*

**C15.** **Lazaridis, L.A., Mikropoulos, P.N., Stassinopoulos, C.A, Kerasaridis, Ch. and Lisaridis, I.: "Corona inception in the presence of insulators in a rod-plane gap under positive switching impulse voltages". *41st Universities Power Engineering Conference*, Newcastle, UK, 2006, Vol. 2, pp. 912-915** [www], [pdf]
Results are presented concerning corona inception in air and in the presence of a porcelain insulator in a non-uniform field under positive switching impulse voltages. It is shown that in the presence of the insulator both first and second coronas start earlier, under lower inception voltages and with smaller associated charges compared to corona inception in air alone. Where the insulator is present, the first and second corona inception voltages and the required voltage increase during dark period increase linearly with the applied voltage. This is not so in the case of corona inception in air alone where the second corona inception voltage was found roughly constant, independent of the applied voltage variations. The apparent first and second corona charges were found to increase with the corresponding inception voltages according to a power and an exponential law respectively.

**C16.** **Mikropoulos, P.N., Stassinopoulos, C.A., Stapountzi, M. and Sarigiannidou, B.C.: "Streamer propagation and flashover along insulator surface in a uniform field in air: Influence of humidity". *41st Universities Power Engineering Conference*, Newcastle, UK, 2006, Vol. 2, pp. 916-920** [www], [pdf]
Results are presented concerning the influence of humidity on streamer propagation and flashover along a PTFE cylindrical insulator in a uniform field in air. Experiments were carried out in a three electrode arrangement consisting of a parallel-plane gap (12 cm), stressed by negative DC voltage and a needle in the earthed anode. Positive streamers were initiated by applying a pulse voltage at the needle electrode and propagate along the insulator surface. Streamer properties investigated are the electric field required for stable streamer propagation and the propagation velocity with field values sustaining stable streamer propagation and also under "overfields". The electric field required for flashover and the corresponding time were measured. It is shown that the electric field required for stable streamer propagation and the associated velocity increase with increasing humidity, whilst under "overfields" high humidity causes streamers to decelerate. Time to breakdown tends to decrease while the required field to breakdown increases with increasing humidity.

**C17.** **Mavroidis, P.N., Mikropoulos, P.N., and Stassinopoulos, C.A.: "Discharge characteristics in short rod-plane gaps under lightning impulse voltages of both polarities". *42nd Universities Power Engineering Conference*, Brighton, UK, 2007, pp. 1070-1074** [www], [pdf]
Results are presented concerning prebreakdown phenomena and breakdown in short rod-plane gaps in air under lightning impulse voltages of both polarities. Breakdown probability distributions were obtained and the discharge parameters such as first and second corona inception time and voltage, dark period, time and voltage required for the discharge to arrive at the earthed plane and for breakdown were measured as a function of gap length and impulse voltage polarity. Breakdown under negative impulse voltages is closely associated with the prebreakdown phenomena since there is a close correlation between coronas inception and breakdown voltages; this is not always the case under positive impulse voltages. For both polarities there is a tight correlation between the breakdown and discharge arrival voltages. At 50% breakdown probability, the mean electric field required for the discharge to arrive at the plane is roughly two times higher under negative than positive impulse voltages and for both polarities it decreases with gap length according to a power law. These explain the similar dependence of the 50% breakdown voltage on polarity and gap length.

**C18.** **Lazaridis, L.A., Mikropoulos, P.N., and Stassinopoulos, C.A.: "Breakdown in air and along a porcelain insulator under positive switching impulse voltages". *15th International Symposium on High Voltage Engineering*, Ljubljana, Slovenia, 2007, paper T4-250, pages 5** [pdf]
Results are presented concerning discharge development and breakdown in air and along a porcelain insulator in a short rod-plane gap under positive switching impulse voltages. Discharge propagation and breakdown

probability distributions were obtained. The times taken for the discharge to cross the gap and for breakdown were measured and the corresponding instantaneous voltages were calculated. The gap was overstressed so as to study the dependence of the discharge characteristics on the crest of the applied voltage. In the presence of the insulator the discharge consists of a “surface” and an “air” component. At voltages causing 50% breakdown probability only the “air” component traverses the full gap and breakdown occurs always in free air. The “surface” component hinders the development of the “air” component resulting in the voltages required for the discharge to cross the gap and for breakdown to be higher in the presence of the insulator than in air alone. For higher applied voltages the “surface” component becomes able to cross the full gap and breakdown may occur also along the insulator’s surface; both the arrival of the discharge at the plane and breakdown occur at shorter times and at lower voltages than in air alone.
*[Precursor of J14]*

**C19.** **Mikropoulos, P.N., and Tsovilis, T.E.: “Experimental investigation of the Franklin rod protection zone”. *15th International Symposium on High Voltage Engineering*, Ljubljana, Slovenia, 2007, paper No. T4-461, pages 5** [pdf]
The protection zone of the Franklin rod is experimentally investigated under standard lightning impulse voltages of both polarities. By using a 75 cm rod-plane gap as a reference case, results are presented relating to the discharge interception probability of an earthed rod inserted in the gap. There is a critical lateral distance between the stressed and earthed rods at which breakdown occurs either to the plane or to the earthed rod with the same probability; this depends on impulse voltage polarity and earthed rod height. The Franklin rod protection zone is designed at different interception probabilities on the basis of an expression defining its boundaries. The protection zone identified according to the rolling sphere method is overestimated for positive lightning but underestimated in the case of negative lightning. An explanation of this behaviour is attempted relating to the breakdown mechanism which is discussed with the aid of electric field calculations.
*[Precursor of J15]*

**C20.** **Mikropoulos, P.N., and Tsovilis, T.E.: “Interception radius and shielding against lightning”. *29th International Conference on Lightning Protection*, Uppsala, Sweden, 2008, paper No. 4-10, pages 11** [pdf]
A comprehensive analysis on shielding against lightning is presented on the basis of simple working relationships which take into account, besides lightning parameters and air terminal height, the interception probability and use as reference the striking distance to earth surface. The present analysis, based on lightning scale model experimental results, includes a comparison with previously reported models, experimental and field data; a satisfactory agreement is found. Lightning incidence calculations have been performed taking into account, besides the statistical distribution of the prospective lightning stroke current, the distribution of interception probability; a close conformity between actual and calculated number of lightning strikes exists.
*[Precursor of J17]*

**C21.** **Mavroidis, P.N., Mikropoulos, P.N., Stassinopoulos, C.A., Rafailidis, P., and Smaragdakis, G.: “Impulse breakdown of short rod-plane air gaps with a dielectric covered rod”. *43rd Universities Power Engineering Conference*, Padova, Italy, 2008, paper No. 147, pages 5** [www], [pdf]
Results are presented concerning breakdown of short rod-plane air gaps with a dielectric-covered rod under positive standard lightning and switching impulse voltages. Breakdown probability distributions were obtained through multiple level tests and the time and voltage to breakdown were measured with the gap length as a parameter. The simple air gaps with a bare rod were considered as reference cases. There is an increase in the dielectric strength of the gap due to the insulating cover, especially under switching impulse voltages. In the presence of the dielectric cover the effect of the impulse waveform on the dielectric strength of the gap is minimal.
*[Precursor of J18]*

**C22.** **Lazaridis, L.A., Mikropoulos, P.N., Daras, A., and Theocharis, A.: “Flashover along cylindrical insulating surfaces under positive lightning impulse voltages”. *XVII International Conference on Gas Discharges and their Applications*, Cardiff, UK, 2008, pp. 233-236** [www], [pdf]
Results are presented concerning discharge development and breakdown along cylindrical insulating surfaces in a 12 cm long rod-plane gap under positive standard lightning impulse voltages. Cylindrical insulator specimens, made of silicone rubber and glazed porcelain, could be inserted parallel to the rod electrode, bridging the gap; the case of air alone was regarded as reference. Discharge development patterns were obtained by oscillographic monitoring of the electric field strength at the earthed plane. An insulating surface, depending on material permittivity, may inhibit the development of the initial corona streamers but favours breakdown.

**C23.** **Mavroidis, P.N., Mikropoulos, P.N., Stassinopoulos, C.A., Dodos, A., and Zannias, P.: “Discharge characteristics in short rod-plane gaps with dielectric-covered rod under lightning impulse voltages”. *XVII International Conference on Gas Discharges and their Applications*, Cardiff, UK, 2008, pp. 289-292** [www], [pdf]
Results are presented concerning both prebreakdown phenomena and the breakdown mechanism in short rod-plane gaps with dielectric-covered rod under positive standard lightning impulse voltages. Characteristic discharge parameters, namely first and second corona inception time and voltage, and time and voltage to breakdown were measured, through multiple level tests, with the gap length as a parameter. The simple air gaps i.e. without any insulating covers were considered as reference cases. In the presence of the dielectric cover breakdown occurs at higher applied voltages as a result of increased both corona inception voltages and discharge path. Interpretation of the results is made based on the discharge development pattern and electric field calculations.
*[Precursor of J18]*

**C24.** **Mikropoulos, P.N., Tsovilis, T.E., and Ananiadis, T: "The effect of an earthed object on the interception radius of the Franklin rod: An experimental investigation". *MedPower 2008*, Thessaloniki, Greece, 2008, paper No. 77 , pages 6 (Peer-review abstract)** [pdf]
The effect of an earthed object on the interception radius of the Franklin rod is experimentally investigated under standard lightning impulse voltages of both polarities. By using a 75 cm rod-plane gap as a reference case, results are presented relating to the discharge interception probability of an earthed rod inserted in the gap together with a neighbouring shorter earthed rod. At certain separation distances between stressed and earthed rods breakdown occurs to either of the earthed electrodes, plane and two rods, with the same probability (33.3%); these critical separation distances depend on impulse voltage polarity and earthed rods height. The experimental results are interpreted in terms of the breakdown mechanism and their possible extension to shielding design is discussed. The interception probability distribution of a Franklin rod is affected by the presence of a neighbouring earthed object.
*[Precursor of J21]*

**C25.** **Mikropoulos, P.N., Tsovilis, T.E., Chatzidimitriou, P, and Vasilaras, P.: "Software development for direct lightning stroke shielding of substations". *MedPower 2008*, Thessaloniki, Greece, 2008, paper No. 78, pages 5 (Peer-review abstract)** [pdf]
A user-friendly Windows application software has been developed for shielding design of high voltage substations against direct lightning strokes; shielding design can be achieved in a few minutes on the basis of a 3-dimensional analysis. With the aid of the software, an installed shielding system can be validated and/or a new system can be designed according to IEEE Standard 998:1996. The performance of different shielding design methods can be easily evaluated for various operating system voltages and equipment dimensions. The developed soft-ware has been applied to the shielding design of typical substations of the Hellenic Transmission System, 150 kV and 400 kV substations and a comparison of the design methods has been made. The application software is a useful tool for electrical engineers and can also be used for educational purposes in high volt-age engineering courses.

**C26.** **Mikropoulos, P.N., and Tsovilis, T.E.: "Lightning attachment models and maximum shielding failure current: Application to transmission lines". *IEEE Bucharest PowerTech*, Romania, 2009, paper No. 233, pages 8** [www], [pdf]
General relationships for the estimation of the maximum shielding failure current of overhead transmission lines have been derived by performing shielding analysis on the basis of several lightning attachment models including a recently introduced statistical one. The interdependence of maximum shielding failure current, transmission line geometry and factors employed in lightning attachment models is discussed through an application to typical 150 kV and 400 kV lines of the Hellenic transmission system. The maximum shielding failure current depends on transmission line geometry and shows a great variability among the lightning attachment models that are used in shielding analysis; electrogeometric models, thus also the IEEE Standard 1243:1997, yield higher values. These results are of great importance when considering that the maximum shielding failure current of transmission lines, besides being employed in estimating their shielding failure flashover rate, is an important parameter for insulation coordination studies.
*[Precursor of J23]*

**C27.** **Mavroidis, P.N., Mikropoulos, P.N., Stassinopoulos, C.A., and Zinonos, M.: "Impulse breakdown of short rod-plane gaps with rod covered with different dielectric materials", *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 271, pages 6** [pdf]
The breakdown mechanism of short rod-plane gaps with a dielectric covered rod under positive standard lightning and switching impulse voltages is investigated. Two different dielectric covers, made of PTFE and epoxy resin, were used and the simple air gaps with a bare rod were regarded as reference. Breakdown probability distributions were obtained and the time and voltage to breakdown were measured. Under lightning impulses the increase of the dielectric strength due to the dielectric cover is little dependent upon the cover material and only slightly higher to that of a simple air gap including the cover length. Under switching impulses this increase is greater; the presence of a dielectric cover results in a reduced effect of the impulse waveshape on the dielectric strength. Most of the times, the spark channel develops along the dielectric cover under lightning impulses whereas, under switching impulses it develops either partly or solely in free air away from the cover surface. The increase in the dielectric strength of the gaps due to the dielectric cover is associated with the effects on the discharge development pattern of the coronas preceding breakdown.
*[Precursor of J25]*

**C28.** **Mikropoulos, P.N., and Tsovilis, T.E.: "A statistical method for lightning incidence calculations in transmission lines", *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1611, pages 5** [pdf]
A statistical method for lightning incidence calculations in transmission lines is introduced. Simple expressions for the estimation of an expected range of lightning strikes to a transmission line depending on interception probability distribution have been obtained, based on a recently proposed statistical lightning attachment model derived from scale model experiments. The expected number of lightning strikes depends, besides transmission line geometry, on lightning stroke current distribution and interception probability. The results of the statistical method have been compared with those obtained by employing other models from literature, including that suggested by the IEEE Std. 1243:1997, in lightning incidence calculations, and with field observation data; a satisfactory agreement has been shown to exist. Results on lightning incidence calculations are further discussed through an application to typical 150 kV and 400 kV lines of the Hellenic transmission system.
*[Precursor of J20]*

**C29.** **Lazaridis, L.A., and Mikropoulos, P.N.: "Influence of humidity on positive impulse flashover along cylindrical insulating surfaces bridging a short rod-plane gap", *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 954, pages 5** [pdf]
Positive impulse flashover of a short rod-plane gap bridged by cylindrical insulating surfaces has been investigated in a wide range of absolute humidity variation. Silicon rubber and porcelain insulators with a smooth surface were inserted parallel to the rod, which was stressed by positive standard lightning and switching impulse voltages; air alone was regarded as reference. A capacitive probe positioned at the centre of the earthed plane connected to a digital oscilloscope enabled the monitoring of the electric field strength at the plane. Flashover probability distributions were obtained and the time and voltage to flashover were measured. In the presence of an insulating surface the dielectric strength is reduced under lightning impulses but increased under switching impulses when compared to the case of air alone. Increasing humidity results in shorter time to flashover and increased surface dielectric strength, however, these humidity effects depend upon the trajectory of the spark channel. With the only exception of the porcelain surface under lightning impulses, the discharge develops away from the insulating surface in free air; hence, the effect of humidity on flashover is similar to that observed in the simple air gap. Where flashover occurs close to the insulating surface the atmospheric conditions correction procedure according to IEC 60060-1:1989 should be optimised by employing a reduced humidity coefficient.

**C30.** **Mikropoulos P.N., and Zagkanas V.N.: "A computational method for positive corona inception in the coaxial cylindrical electrode arrangement in air under variable atmospheric conditions", *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1606, pages 6** [pdf]
Corona discharge has many practical applications, thus it has been studied extensively experimentally as well through modelling in many electrode arrangements. In the present study a computational method for the estimation of the positive corona inception field strength in the coaxial cylindrical electrode arrangement in air is presented. It is based on streamer theory and involves Hartmann's expression for the field dependent effective ionization coefficient and the known distribution of the geometric electric field. A very good agreement with literature experimental data referring to wire-cylinder air gaps has been observed for an avalanche number of $10^4$ (ionization integral ~9.2) in a wide range of wire radii and under variable atmospheric conditions. A simple absolute humidity correction factor has been introduced in Peek's formula, allowing for an accurate estimation of the corona inception field strength under variable humidity.

**C31.** **Mikropoulos, P.N., Tzimkas, L.C., Giannopoulos, T., and Tsintikidis, P.: "Positive streamer on propagation along profiled insulating surfaces with room temperature vulcanized silicone rubber coatings", *16th International Symposium on High Voltage Engineering*, Cape Town, South Africa, 2009, paper No. 1202, pages 6** [pdf]
Results on positive streamer propagation along smooth and profiled cylindrical insulating surfaces coated with different room temperature vulcanized (RTV) silicon rubber coatings are presented; nylon specimens were regarded as reference. Experiments were carried out in a three electrode arrangement consisting of a 12 cm long parallel-plane gap with an auxiliary needle in the earthed anode. Streamers were initiated by applying at the needle electrode a pulse voltage variable in amplitude and propagated over the insulators towards the upper plane electrode which was stressed by a negative DC voltage. When streamers propagate stably along an insulating smooth surface the propagation field and the associated velocity are both higher for RTV coated than bare insulators, however when they propagate along a profiled insulating surface with a step or a shed this reverses itself. The effect of a step or a shed on an insulating surface is to increase propagation field, with the only exception where a streamer crosses part of the gap in air alone, and to reduce the velocity of propagation at all applied fields. The increase of streamer propagation field due to surface profile is less marked for RTV coated than bare insulating surfaces whereas the reduction of propagation velocity is more pronounced.

**C32.** **Mavroidis, P.N., Mikropoulos, P.N., and Stassinopoulos, C.A.: "Impulse corona inception in dielectric covered rod-plane air gaps". *44th Universities Power Engineering Conference*, Glasgow, Scotland, 2009, paper No. 57-34220, pages 4** [www], [pdf]
Positive corona inception in dielectric covered rod-plane air gaps stressed by lightning and switching impulse voltages is investigated. Corona inception probability distributions were obtained and the salient characteristics of the corona discharge, namely inception time and voltage, were measured as influenced by the gap length, waveshape of the applied impulse voltage and by the cover material, namely PTFE and epoxy resin. The simple air gaps with a bare rod were regarded as reference. The corona inception voltage increases significantly due to the insulating cover, especially for the PTFE cover under switching voltages. Electric field computations were performed. The corona inception field is, contrary to the inception voltage, lower for the dielectric covered rod-plane than simple rod-plane air gaps; an assisting mechanism for initiatory electrons production is suggested to explain this behaviour.

**C33.** **Mikropoulos, P.N., and Tsovilis, T.E.: "Lightning attachment models and perfect shielding angle of transmission lines". *44th Universities Power Engineering Conference*, Glasgow, Scotland, 2009, paper No. 57-70151, pages 5** [www], [pdf]
General relationships for the estimation of the perfect shielding angle of overhead transmission lines have been derived by performing shielding analysis on the basis of several lightning attachment models, including a recently introduced statistical model. The interdependence of perfect shielding angle, transmission line height and minimum current causing flashover of insulation is demonstrated as influenced by the lightning attachment model employed in shielding analysis. There is a great variability in perfect shielding angle among lightning attachment models; this is demonstrated for 150 kV and 400 kV lines of the Hellenic transmission system. The applicability of lightning attachment models in perfect shielding angle calculations is evaluated based on the shielding performance of transmission lines. Some electrogeometric models, including that proposed by IEEE Std

1243:1997, and the statistical model yield consistent results with respect to the shielding performance of the lines.

***As Associate Professor***

**C34.** **Mikropoulos P.N., and Tsovilis T.E.: "Lightning interception probability and shielding performance of overhead transmission lines". *30th International Conference on Lightning Protection*, Cagliari, Italy, 2010, paper No. 1274, pages 7** [pdf]
Shielding performance of overhead transmission lines is evaluated by implementing in shielding analysis a statistical model of lightning attachment. The effects of transmission line parameters, lightning peak current distribution and interception probability on shielding failure flashover rate are investigated and discussed. An application has been made to several overhead transmission lines including typical lines the Hellenic transmission system. Results are compared with that obtained by employing in shielding analysis some commonly used electrogeometric models. The estimated shielding failure flashover rate, showing a great variability among lightning attachment models, is much more sensitive to transmission line geometry for the IEEE Standard 1243:1997, which yields the highest values among models. For all lightning attachment models employed in shielding analysis the estimated shielding failure flashover rate of several overhead transmission lines is in qualitative agreement but in quantitative inconsistency with field data.
*[Precursor of J26]*

**C35.** **Mikropoulos P.N., Tsovilis T.E., Datsios Z.G., and Mavrikakis N.C.: "Effects of simulation models of overhead transmission line basic components on backflashover surges impinging on GIS substations". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 72, pages 6** [www], [pdf]
Overvoltages arising in 150 kV and 400 kV GIS substations due to backflashover of the incoming overhead transmission lines were computed with the aid of ATP-EMTP simulations, by considering the effects of several simulation models of the basic transmission line components. The protection offered against impinging surges by surge arresters operating at the substation entrance is evaluated with respect to the basic insulation level of the GIS system. The computed overvoltages vary considerably among tower grounding system models and among insulator string flashover models whereas rather insignificantly among tower simulation models. There is no systematic variation in computed overvoltages among insulator string flashover models. Single vertical lossless line models and a constant rather than a current dependent resistance are considered, in terms of simulation simplicity and safe design, as satisfactory for simulating transmission line tower and its grounding resistance, respectively, in insulation coordination studies of substations.

**C36.** **Mikropoulos P.N., Tsovilis T.E., and Zlitidis D.E.: "Software development for the evaluation of the lightning performance of overhead transmission lines". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 84, pages 6** [www], [pdf]
A useful tool for the evaluation of the lightning performance of overhead transmission lines has been developed in Matlab. The software (LPTL) runs as a Microsoft Windows application and features a user-friendly graphics interface. For given overhead transmission line parameters, ground flash density and lightning crest current distribution the lightning performance of the line can be easily evaluated according to several lightning attachment models. Through an application to a typical 400 kV double circuit line of the Hellenic transmission system the effects of lightning attachment model and lightning crest current distribution on the lightning performance of the line are quantified. Generally, electrogeometric models yield the highest shielding failure flashover rate whereas the lowest backflashover rate. As the median value of the lightning crest current distribution increases the shielding failure flashover rate decreases whereas backflashover rate increases. The application software is a useful tool for utilities and can also be used for educational purposes in high voltage engineering courses.

**C37.** **Mavroidis P.N., Mikropoulos P.N., Stassinopoulos C.A., and Tsirolias L.P.: "Surface corona development in dielectric covered rod-plane air gaps under impulse voltages". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 142, pages 5** [www], [pdf]
Surface corona development in short rod-plane air gaps with a dielectric covered rod under positive lightning and switching impulse voltages is investigated. Discharge activity was recorded through still photographs and oscillograms of the electric field strength at the earthed plane. The gap length, impulse waveshape and material of the dielectric cover were considered as influencing parameters. The extent of development of the surface corona along the dielectric cover becomes greater with increasing applied voltage and field and with decreasing gap length. Also, it is greater for lightning than switching impulse voltages and occurs at significantly lower applied field for the PTFE than epoxy resin cover. Surface corona development, being greatly dependent on the characteristics of the initial corona emerging in the vicinity of the cover tip, affects the inception of the corona emerging at the dielectric cover upper end, thus also breakdown.
*[Precursor of J25]*

**C38.** **Mikropoulos P.N., and Zagkanas V.N.: "Computation of negative corona inception field strength in the coaxial cylindrical electrode arrangement under variable air density". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 169, pages 5** [www], [pdf]
Corona discharge has attracted much interest among researchers as it has a lot of applications in industry and a number of effects on power systems. In the coaxial cylindrical electrode arrangement in air, simulating many practical applications, corona inception depends on the electric field strength around the inner conductor and on atmospheric conditions. In the present study a computational method for the estimation of the negative corona inception field strength in the coaxial cylindrical electrode arrangement under variable air density is presented. The method is based on streamer theory, involves Hartmann's expression for the effective ionization coefficient and considers the effect of the space charge field on avalanche growth. The computed negative corona inception

field strength is in good agreement with literature experimental data for an avalanche number varying with the product of relative air density and inner conductor radius. Streamer formation occurs rather through a multi-avalanche process, assisted by subsidiary avalanches owing to secondary ionization processes at the cathode and in air. Peek's empirical formula for estimating corona inception field strength in the coaxial cylindrical electrode arrangement in air agrees satisfactorily with literature experimental data referring to negative corona inception.

**C39.** **Mikropoulos P.N., and Tzimkas L.C.: "Influence of humidity on surface streamer propagation in a uniform field in air". *45th Universities Power Engineering Conference*, Cardiff, Wales, 2010, paper No. 239, pages 5** [www], [pdf]

Knowledge of surface streamer characteristics as influenced by the insulating surface and atmospheric conditions is important for the better understanding of the flashover mechanism, hence also for an efficient design of insulating systems under various environmental conditions. In the present study positive streamer propagation along PTFE and Nylon cylindrical insulating surfaces is investigated in a uniform field in air under variable absolute humidity. Streamers were initiated by applying at an auxiliary needle electrode, located at the earthed anode plane electrode, a pulse voltage variable in amplitude and propagated along an insulating surface towards the upper plane electrode, which was stressed by negative DC voltage. The electric fields required for threshold and stable surface streamer propagation and the velocity of stable streamer propagation, being higher than that for air alone and also slightly higher for PTFE than Nylon insulator, increase with absolute humidity. Empirical relationships have been derived, accurately expressing the effects of absolute humidity on surface streamer propagation field and velocity. Results are compared to that obtained in the case of streamer propagation in air alone based on previous work.

**C40.** **Mikropoulos P.N., Tsovilis T.E., Manousaridis I., Laloumis G., and Dramis A.: "Lightning risk assessment of a 170 kV GIS substation connected to the Hellenic Transmission System through underground cables". *MedPower 2010*, Agia Napa, Cyprus, 2010, paper No. 166** [www], [pdf]

Lightning risk assessment of a 170 kV GIS substation connected to the Hellenic transmission system through underground cables has been performed. Fast-front overvoltages impinging on the substation due to shielding failure and backflashover of the incoming overhead transmission lines have been computed with the aid of ATPEMTP simulations and evaluated with respect to the insulation level of the substation equipment. The mean time between failures of the substation is greatly reduced for higher tower grounding resistance and varies significantly among lightning attachment models employed for the evaluation of the lightning performance of the incoming overhead transmission lines. Implementation of the IEEE Std 1243:1997 in lightning risk assessment of substations imposes high requirements on protection against incoming fast-front overvoltage surges.

**C41.** **Mikropoulos P.N., Tsovilis T.E., Kagiannas A., and Politis Z.: "Evaluation of fast-front overvoltages arising at a 20/0.4 kV distribution transformer". *MedPower 2010*, Agia Napa, Cyprus, 2010, paper No. 191** [www], [pdf]

Fast-front overvoltages arising at or transferred to the medium-voltage and low-voltage terminals of a 20/0.4 kV distribution transformer are evaluated with the aid of ATPEMTP simulations. The effects of lightning crest current and of the transformer and load grounding resistances on the computed overvoltages are investigated. The protection against lightning surges offered by surge protective devices installed close to the low-voltage terminals of the distribution transformer is evaluated. The peak of the overvoltage arising at the medium-voltage terminals of the distribution transformer may exceed the corresponding insulation level even when surge arresters are operating close to the latter. The peak of the overvoltage arising at or transferred to the low voltage terminals of the distribution transformer may exceed the corresponding insulation level when surge protective devices are not installed. When surge protective devices are installed, the overvoltages are significantly reduced and practically unaffected by transformer and/or load grounding resistances.

**C42.** **Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: "Shielding failure current of overhead transmissions lines generated through an ATPDraw object". *International Conference on Power Systems Transients* - IPST 2011, Delft, The Netherlands, 2011, paper No. 38, pages 5** [www], [pdf]

The maximum shielding failure current of overhead transmission lines is an important parameter in evaluating the shielding performance of the lines and performing insulation coordination studies of the connected substations. A new ATPDraw object has been developed, by using MODELS language, that easily generates the maximum shielding failure current of overhead transmission lines, with amplitude and waveshape depending on line geometry and selected lightning attachment model. The new object, called MSFC, was employed in ATP-EMTP simulations of a 150 kV GIS substation. The computed shielding failure surges impinging on the substation, being dependent upon maximum shielding failure current, vary considerably among lightning attachment models. The MSFC object is a useful tool within the ATP-EMTP environment in assessing the shielding failure surges arising at overhead transmission lines and impinging on the connected substations.

**C43.** **Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: "Impulse resistance of concentrated tower grounding systems simulated by an ATPDraw object". *International Conference on Power Systems Transients* - IPST 2011, Delft, The Netherlands, 2011, paper No. 39, pages 5** [www], [pdf]

Tower grounding system accurate modeling is very important in evaluating the backflashover surges arising at overhead transmission lines and impinging on the connected substations. A new ATPDraw object, called TGIR, has been developed with the aid of which a concentrated tower grounding system can be represented on the basis of several tower grounding system models. The TGIR object was employed in ATP-EMTP simulations of a 150 kV GIS substation. The computed backflashover surges impinging on the substation vary considerably among the tower grounding system models employed in simulations, as a result of the variability in the grounding impulse resistance. The TGIR object is a useful tool within the ATP-EMTP environment for insulation co-

ordination studies; the effects of tower grounding system modeling on backflashover surges arising at overhead transmission lines and impinging on the connected substations can be easily quantified.

**C44.** **Mikropoulos P.N., and Tsovilis T.E.: "A statistical method for the estimation of induced-voltage flashover rate of unshielded overhead distribution lines". *17th International Symposium on High Voltage Engineering*, Hannover, Germany, 2011, paper No. B-23, pages 5** [pdf]
Lightning is a major cause of distribution line outages affecting reliability of power supply thus, consequently, resulting in economic losses. Line insulation flashover in overhead distribution lines may be caused by overvoltages associated with direct or nearby lightning strokes. In this paper a statistical method for the estimation of the induced-voltage flashover rate of unshielded overhead distribution lines due to nearby strokes is introduced. The proposed method yields a range for the expected induced voltage flashover rate of the line, by considering, besides line parameters and lightning crest current distribution, the lightning interception probability distribution of the line phase conductors. Results of the statistical method are compared with those yielded by the methods suggested in IEEE Std. 1410:2004 and its recent revision IEEE Std. 1410:2011; a satisfactory agreement is shown to exist. An application of the statistical method to a typical 20 kV unshielded line of the Hellenic distribution system is made.
*[Precursor of J27]*

**C45.** **Mikropoulos P.N., and Zagkanas V.N.: "Modelling of positive corona inception in the coaxial cylindrical electrode arrangement under variable air density". *17th International Symposium on High Voltage Engineering*, Hannover, Germany, 2011, paper No. E-052, pages 6** [pdf]
Corona discharge has attracted much interest among researchers as it has a lot of applications in industry and a number of effects on power systems. Corona inception in the coaxial cylindrical electrode arrangement, which finds many practical applications, depends on the electric field strength around the inner conductor and on atmospheric conditions. In the present study a new model for positive corona inception in a steady or slowly-varying electric field is presented. The model, implementing streamer criterion, assumes that an equivalent electron avalanche develops towards the anode by virtue of ionization by collision and photoionization in an electric field distorted by the avalanche space charge. Based on a great amount of literature experimental data, a new empirical expression for the estimation of positive corona inception field strength has been derived. The formulation of a photoionization coefficient as a function of inner conductor radius and relative air density enabled the investigation of the effects of the latter parameters on the basic characteristics of the avalanche at corona inception, namely critical avalanche length, radius, number and electron density.

**C46.** **Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: "Insulator string flashover modelling with the aid of an ATPDraw object". *46th Universities Power Engineering Conference*, Soest, Germany, 2011, paper No. 102, pages 5** [www], [pdf]
Accurate modeling of line insulation flashover is very important in evaluating the fast-front surges arising at overhead transmission lines and impinging on the connected substations. A new ATPDraw object, called ISF, has been developed with the aid of which insulator string flashover is modeled on the basis of several flashover models from literature. The ISF object was employed in ATP-EMTP simulations of a 150 kV GIS substation. The computed backflashover surges impinging on the substation vary considerably among the insulator string flashover models employed in simulations. The ISF object is a useful tool within the ATP-EMTP environment for insulation co-ordination studies. The effects of insulator string flashover modeling on backflashover surges arising at overhead transmission lines and impinging on the connected substations can be easily quantified.

**C47.** **Mikropoulos P.N., Zagkanas V.N., and Koustoulidis T.S.: "Experimental investigation of DC corona on stranded conductors under variable air density". *47th Universities Power Engineering Conference*, London, United Kingdom, 2012, paper No. 112, pages 6** [www], [pdf]
Knowledge on the effects of air density on corona discharge is of great importance for many practical applications, including overhead transmission lines. In the present study the salient characteristics of both positive and negative DC corona on 7-stranded conductors, namely the corona inception voltage, corona current and the associated power losses, are experimentally investigated in the coaxial cylindrical electrode arrangement under variable air density. Theoretical predictions of the corona current and losses are in good agreement with experimental values for an ion mobility decreasing with relative air density according to a power law, the rate of decrease being higher for negative than positive ions. Irregularity factors for the 7-stranded conductors have been obtained based on electric field simulations and Peek's formula for smooth conductors. Logarithmic expressions, describing well the dependence of the irregularity factor on the product of relative air density and conductor radius, allow for a satisfactory estimation of the corona inception field strength of 7-stranded conductors.

**C48.** **Mikropoulos P.N., Tsovilis T.E., and Papaioannou P.P.: "Software development for the evaluation of the lightning performance of overhead distribution lines on the basis of the statistical method". *47th Universities Power Engineering Conference*, London, United Kingdom, 2012, paper No. 141, pages 5** [www], [pdf]
A useful application software for the evaluation of the lightning performance of overhead distribution lines is introduced. The SM-LPDL software has been developed in Matlab, runs as a Microsoft Windows application and features a user-friendly graphics interface. It incorporates a statistical method for the estimation of the flashover rate of overhead distribution lines, implementing a recently introduced statistical lightning attachment model and the simplified coupling model suggested by the IEEE Std. 1410:2011. The SM-LPDL yields a range for the expected flashover rate of a distribution line associated with the lightning interception probability distribution of the line conductors. It allows for the easy quantification of the effects of line parameters, soil resistivity, surge arresters, shielding of nearby objects and lightning crest current distribution on lightning performance of

distribution lines. SM-LPDL results are discussed and compared with those obtained by the recently released IEEE Std. 1410:2011.

**C49.** **Datsios Z.G., and Mikropoulos P.N.: "Safe grounding system design for a photovoltaic power station". *MedPower 2012*, Cagliari, Italy, 2012, paper No. 62, pages 6** [www], [pdf]
A safe and cost-efficient grounding system design of a 3 MWp photovoltaic power station according to IEEE Std 80-2000 is presented. Grounding analysis is performed by considering the metal parts of the photovoltaic panel arrays foundations as auxiliary ground electrodes. Utilizing also horizontal ground conductors, required solely for the interconnections of the metal support structures of the photovoltaic panel arrays, both safety and cost-efficiency in grounding system design have been achieved. It is shown that in large-scale photovoltaic power stations where the metal parts of the panel arrays foundations are concrete encased the concrete resistivity is not an important parameter in evaluating the safety performance of the grounding system.

**C50.** **Datsios Z.G., Mikropoulos P.N., and Tsovilis T.E.: "Estimation of the minimum shielding failure current causing flashover in overhead lines of the Hellenic transmission system". *31st International Conference on Lightning Protection*, Vienna, Austria, 2012, paper No. 272, pages 5** [www], [pdf]
ATP-EMTP simulations are performed to estimate the minimum shielding failure current causing flashover in 150 kV and 400 kV double-circuit overhead lines of the Hellenic transmission system. This critical current is of great importance for estimating the shielding failure flashover rate and assessing the insulation coordination of overhead transmission lines. It is shown that the minimum shielding failure current causing flashover varies significantly among the insulator string flashover models employed in simulations, which include volt-time curves and leader development models. The minimum shielding failure current causing flashover calculated on the basis of the relevant IEEE Std is significantly lower than that obtained through ATP-EMTP simulations. The computed shielding failure flashover rate of the 150 kV and 400 kV overhead transmission lines is greatly affected by the method adopted for the estimation of the minimum shielding failure current causing flashover.
*[Precursor of J28]*

**C51.** **Mikropoulos P.N., and Zagkanas V.N.: "The effect of stranded conductor geometry on DC corona in the coaxial cylindrical electrode arrangement in air". *48th Universities Power Engineering Conference*, Dublin, Ireland, 2013, paper No. 276, pages 5** [www], [pdf]
The effect of stranded conductor geometry on the salient characteristics of DC corona, namely corona inception voltage, corona conductance and the associated power losses is experimentally investigated in the coaxial cylindrical electrode arrangement in air. The number of strands of the conductor has a greater impact on the characteristics of positive than negative corona. Under conditions of high absolute humidity, corona conductance, thus also losses depending on conductor geometry can be higher for positive than negative corona. Breakdown, only slightly affected by stranded conductor geometry, is greatly facilitated by the space charge associated with multiple coronas occurring along the energised conductor. An empirical expression for the estimation of the irregularity factor of overhead transmission line conductors is proposed, accounting well for the effects of stranded conductor radius, stranding ratio and relative air density.

**C52.** **Mikropoulos P.N., and Zagkanas V.N.: "Impulse corona inception in the coaxial cylindrical electrode arrangement in air: effects of the steepness of the applied voltage". *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. PE-50, pages 5** [pdf]
The effect of the steepness of overvoltage surges propagating along overhead transmission lines on corona characteristics is of great importance for insulation coordination studies. Corona inception voltage on line conductors under fast-front overvoltages is commonly estimated through Peek's empirical formula, which however was obtained for steady or slow-varying electric fields. In the present study experimental results on impulse corona in the coaxial cylindrical electrode arrangement in air are presented, with the wavefront duration and the polarity of the applied voltage as parameters. Corona discharge has been investigated at both threshold and overstress conditions by obtaining inception probability distributions and U-t curves. An empirical expression describes well the experimentally derived U-t characteristic. A modified Peek's formula is proposed taking into account the effect of the steepness of the applied impulse voltage on corona inception field strength. The integration method, commonly used for the estimation of the impulse breakdown voltage of non-uniform air gaps, has been implemented to estimate the corona inception time and voltage; a very good agreement exists between calculated and measured values.

**C53.** **Datsios Z.G., Mikropoulos P.N., Politis Z., Kagiannas A.G., and Tsovilis T.E.: "Protection of distribution transformer against arising or transferred fast-front overvoltages: effects of surge arrester connection conductors' length". *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. OB2-04, pages 6** [pdf]
The effects of the length of the surge arrester connection conductors on the lightning surges impinging on a typical wood pole-mounted 50 kVA, 20/0.4 kV transformer of the Hellenic distribution system are investigated through detailed ATP-EMTP simulations. By considering both first and subsequent direct lightning strokes to a connected overhead distribution line, the effectiveness of the common practice transformer protection scheme and of an alternative one utilizing shorter surge arrester connection conductors in suppressing fast-front overvoltages was evaluated. A shorter length of the surge arrester connection conductors results in a reduction in the amplitude of the overvoltages arising at the medium-voltage terminals of the transformer and in a slower rate of increase of the overvoltage amplitude with lightning return-stroke current. The overvoltages transferred to the low-voltage terminals of the transformer are practically not affected by the length of the surge arrester connection conductors. Protection against transferred overvoltages was provided by surge protective devices installed at the low-voltage terminals of the transformer. By utilizing shorter surge arrester connection conductors the transformer failure rate, estimated through risk assessment, is reduced by approximately 11%.

**C54.** **Mikropoulos P.N., and Tsovilis T.E.: "Evaluation of lightning incidence to ESE rods". *18th International Symposium on High Voltage Engineering*, Seoul, Korea, 2013, paper No. OB2-06, pages 5** [pdf]
A methodology for the estimation of lightning incidence to free standing Early Streamer Emission (ESE) rods is introduced. The proposed method implements a general expression for the equivalent interception radius, which considers the ESE rod height, length of the triggered upward connecting leader and the lightning peak current distribution. Lightning incidence results are discussed and compared with that referring to conventional rods obtained according to Eriksson's method and the statistical lightning attachment model. It is shown that the lightning interception efficiency of an ESE rod, even assuming an earlier initiated upward connecting leader, is similar to that of a conventional rod when considering a realistic value for the progression velocity of the upward connecting leader. The present work provides the means to easily evaluate the lightning interception efficiency of ESE and conventional rods through comparisons with available field data.

**C55.** **Datsios Z.G., Mikropoulos P.N., Teneketzoglou A., and Tzikas D.: "Safety performance evaluation of fence grounding configurations in high voltage installations". *49th Universities Power Engineering Conference*, Cluj-Napoca, Romania, 2014, accepted** [pdf]
The design of the grounding configuration for the metal fence of a high voltage installation is important as the outside perimeter of the fence is accessible to the general public. In this work the safety provided by several fence grounding techniques commonly used in high voltage installations is evaluated for a 150/20 kV air insulated substation, a 400 kV step-up GIS substation and a large scale photovoltaic power station with the aid of grounding analysis software. A safe and cost-efficient fence grounding design depends on ground fault characteristics, soil conditions, installation area, distance between the fence and grounding grid as well as on the size and geometry of the latter.

**C56.** **Mavrikakis N., Siderakis K., and Mikropoulos P.N.: "Laboratory investigation on hydrophobicity and tracking performance of field aged composite insulators". *49th Universities Power Engineering Conference*, Cluj-Napoca, Romania, 2014, accepted** [pdf]
Evaluation of the field performance of composite insulators is essential for maintaining the desired levels of reliability in power networks. Field performance of composite insulators depends on many factors, including the insulator design, material quality and service conditions experienced. The most critical part of the composite insulator is its external housing, usually made of silicone rubber having the advantage of recovering its hydrophobic properties in polluted conditions. Thus, condition assessment of the hydrophobic properties of the housing material especially under erosion and tracking processes is of major importance. In this study performance evaluation of the housing material of 150 kV field-aged silicone rubber insulators is carried out through physical, electrical and material analysis techniques. The hydrophobic properties of the housing material were found degraded to a different extent between field-aged insulators due to differences in material structure and pollution conditions. Hydrophobicity can be better assessed if the relevant diagnostic techniques are also applied after inclined plane tests.

**C57.** **Datsios Z.G., and Mikropoulos P.N..: "Implementation of leader development models in ATP-EMTP using a Type-94 circuit component". *32nd International Conference on Lightning Protection*, Shanghai, China, 2014, accepted** [pdf]
Evaluation of the dielectric strength of transmission line insulation subjected to fast-front overvoltages is of major importance for the insulation coordination of overhead lines and the connected substations. Among models proposed in literature for the prediction of the dielectric behavior of air gaps and insulators leader development models have a more physical ground. In this study several leader development models are implemented in a new model in ATP-EMTP using MODELS simulation language. The new model is solved simultaneously with the rest of simulated system interacting with it as a circuit element; this is accomplished by using the model with a type-94 circuit component. The developed model is verified against literature data referring to breakdown of long air gaps. Shielding failure and backflashover simulations are performed for a 150 kV and a 400 kV overhead transmission lines to investigate the effects of modeling of the predischarge current flowing during leader propagation phase on the estimated critical currents.

**C58.** **Mikropoulos P.N., Tsovilis T.E., and Pori A.S.: "Evaluation of lightning attachment and coupling models for the estimation of the lightning performance of overhead distribution lines". *32nd International Conference on Lightning Protection*, Shanghai, China, 2014, accepted** [pdf]
The lightning performance of overhead distributions lines affects significantly the reliability of distribution power network. Lightning-related flashover of line insulation is caused by direct and nearby strokes. This paper presents a generalized methodology for the estimation of the flashover rate of overhead distribution lines that considers several lightning attachment and coupling models. Results of the proposed methodology are discussed and compared with A. J. Eriksson's field observations. Based on the consistency between estimated values and field data suggestions are made for the appropriate selection of lightning attachment and coupling models for the evaluation of the lightning performance of distribution lines.

## IV. Publications in Greek Technical Magazines

**G1.** **Ζ. Γ. Δάτσιος και Π. Ν. Μικρόπουλος, «Σχεδίαση ασφαλούς συστήματος γείωσης για Φ/Β σταθμό», Σύγχρονη Τεχνική Επιθεώρηση [Modern Technical Review], Τεύχος 246, σελ. 16-21, Νοέμβριος-Δεκέμβριος 2012**
*[Cf. C49, Invited]*

## V. Lecture Notes

i. **P.N. Mikropoulos, "Laboratory exercises in High Voltage Technology", for the courses: High Voltage Engineering I and II, pages 178**
Introduction to high voltage laboratory technology. Test transformers. Generation and measurement of AC high voltages. Generation and measurement of DC high voltages. Generation and measurement of Impulse high voltages. Transient response of high voltage dividers. Estimation of the breakdown voltage of non-uniform air gaps. Voltage distribution along line insulator strings. Partial discharge detection and measurement of their salient characteristics. Determination of the electric strength of insulating oils.

ii. **P.N. Mikropoulos, "Exercises in High Voltage Technology", for the courses: High Voltage Engineering I and II, pages 79**
Generation and measurement of DC high voltages. Generation and measurement of Impulse high voltages. High voltage dividers. Generation and measurement of high impulse currents. Dielectric measurements and partial discharges. Voltage distribution along line insulator strings. High voltage cables.

iii. **P.N. Mikropoulos, "Introduction to HVDC Transmission Systems", for the course: High Voltage Engineering II, pages 18**
Development of HVDC technology. Classification of HVDC transmission systems. Layout of HVDC transmission systems. Comparison between HVAC and HVDC transmission systems.

iv. **P.N. Mikropoulos, "Lightning Protection Systems", for the course: High Voltage Engineering III, pages 81**
Lightning. Lightning stroke current parameters. Lightning effects on structures, occupants and contents. Lightning Protection Systems (LPS): general principles, non-conventional LPS. Risk management: need and economic justification for lightning protection. Design of LPS. External LPS: air-termination systems, down-conductor systems, earth-termination systems, components, materials and dimensions. Internal LPS: protection zones, equipotential bonding, surge protective devices, electrical insulation. Lightning protection zones: protection against voltage and electromagnetic disturbances.

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