Application of Line Surge Arresters in Power Distribution and Transmission Systems

PROGRAMME

Hotel Croatia
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1. WORD OF WELCOME

Dear Colleagues and Friends,

Welcome to the International Colloquium on “Application of Line Surge Arresters in Power Distribution and Transmission Systems” to be held in Cavtat, Croatia.

The Colloquium is organized under the umbrella of the CIGRÉ Study Committee C4 (System Technical Performance) in cooperation with the Croatian National Committee and Study Committees A3 (High Voltage Equipment) and B2 (Overhead Lines).

The goal of the Colloquium is to examine the various aspects of line surge arresters application and it is addressed to power utilities, equipment manufacturers, design engineers, system operators, universities, testing laboratories, research institutes and other organizations in the electricity industry. The Colloquium offers an opportunity for all participants to discuss key current topics about the line surge arresters.

On behalf of the Organizing Committee, I warmly welcome you to the Colloquium and I hope that you will have an enjoyable time discussing and exchanging ideas with each other.

I also wish you a great stay in Croatia – the land of the thousand islands.

Prof. Ivo Uglešić
Chairman of the Colloquium
2. TECHNICAL COMMITTEE

I. Uglešić (Croatia) Chairman
S. Sadović (France) Co-Chairman
A. Xemard (France) Co-Chairman
M. Babuder (Slovenia)
W. A. Chisholm (USA)
M. T. Correia de Barros (Portugal)
A. da Costa Oliveira Rocha (Brazil)
B. Dalle (France)
A. Dutil (Canada)
M. Ishii (Japan)
T. Lassaigne (France)
C. Neumann (Germany)
C. A. Nucci (Italy)
S. Pack (Austria)
M. Puharić (Croatia)
B. Richter (Switzerland)
A. Sekso (Croatia)
M. Waldron (United Kingdom)

3. ORGANIZING COMMITTEE

Ivo Uglešić – Chairman
Ante Marušić
Viktor Milardić
Miroslav Mesić
Gordan Mirošević
Josip Moser
Irena Tomiša
4. HOST OF SESSION

HRVATSKA ELEKTROPRIVREDA d.d.

HEP—Transmission System Operator Ltd.

5. SPONSORS

DALEKOVOD – SILVER SPONSOR
SIEMENS – BRONZE SPONSOR

ABB
BRODOMERKUR
EDF
HEP
HUBBELL POWER SYSTEMS
KONČAR
MAR–KO–ING
RTE EDF TRANSPORT
SEVES – SEDIVER
TYCO ELECTRONICS RAYCHEM represented by ENCRON
6. PRESENTATIONS OF SPONSORS

HUBBELL POWER SYSTEMS

Frank Lopez:
HUBBELL POWER SYSTEMS, POLYMER INSULATORS AND LINE ARRESTERS FOR TRANSMISSION APPLICATIONS
– Quick introduction about HPS
– Quadri*Sil polymer insulators
– Protecta*Lite line arresters

SEVES–SEDIVER

Damien Lepley:
POLYMER HOUSED HIGH VOLTAGE SURGE ARRESTERS

MAR–KO–ING/TRIDELTA

Volker Engelhardt:
TRIDELTA SURGE ARRESTERS – THE NEW TECHNOLOGIES PRESENTED IN CROATIA

ABB

Frederik Persson:
MAKING ARRESTERS MORE ROBUST BY DESIGN

Bernhard Richter:
ABB MEDIUM VOLTAGE SURGE ARRESTERS–DIMENSIONING, TESTING AND APPLICATION IN MV NETWORKS

HEP–TSO

Jadranko Radovanović, Dalibor Škarica, Goran Ćubra, Mario Gudelj, Miroslav Mesić:
EXPERIENCE ON INSTALLATION AND OPERATION OF LINE SURGE ARRESTERS (LSA) ON LINE
7. INVITED LECTURES

**INVITED LECTURE I**

Masaru Ishii:
CIRCUIT MODEL FOR EVALUATION OF PERFORMANCE OF LINE SURGE ARRESTERS

**INVITED LECTURE II**

William A. Chisholm:
ISSUES IN LONG-TERM RELIABILITY OF TRANSMISSION LINE SURGE ARRESTERS

**INVITED LECTURE III**

Salih Sadović:
DIFFERENT APPLICATIONS OF LINE SURGE ARRESTERS

8. MAIN TOPICS

1. Interaction between LSAs and electrical system
2. Line performance improvement in terms of continuity of service
3. Different applications of LSAs
4. LSA designs (gapless, gap-type)
5. Apparatus aspects of LSA, standardization, testing
6. Simulation/selection tools
7. LSA Selection
8. Installation practice of LSAs/mechanical aspects
9. Field experience with LSAs/reliability
10. LSA monitoring
## 9. PAPERS

1. Installation of LSA on a 400 kV Double–circuit Line in Russia  
   L. Stenström, J. Taylor, N.T. Osiptsov, F. Persson

2. Application of ANN and Genetic Algorithm for Evaluation the Optimum Location of Arresters on Power Networks due to the Switching Overvoltages  
   Reza Shariatinasab, Behrooz Vahidi, Seyed Hossein Hosseinian, Akihiro Ametani

3. Reduction of the number of double–circuit flashovers on a 400 kV overhead line  

4. Line surge arresters potential applications on Hydro–Québec TransÉnergie transmission system  
   P. Prud’homme, A. Dutil

5. Decreasing backflashover numbers on medium voltage overhead lines located in regions with high soil resistivity  
   D. Mišković, I. Uglešić

6. Pilot study on the use of gapless transmission line arresters (TLA) as an alternative to gapped TLA in TNB transmission system  
   Iryani M. Rawi, M. Pauzi Yahaya

7. Evaluation of Energy Stress on Line Arresters  
   I. Uglešić, V. Milardić, B. Filipović–Grčić, A. Tokić
8. Application of Line Surge Arresters in Power Transmission Line in China
ZHANG Cui-xia, FAN Jian-bin, GE Dong, CHEN Xiu-juan

9. Application of gapless surge arresters for lightning protection of transmission and distribution lines
M. G. Comber

10. Basic Study on Deterioration of Transmission Line Arrester
N. Yamada, M. Nakagami

11. Real-time remote monitoring of line surge arresters
M. Muhr, T. Sadović

12. Line surge application on the compact transmission lines
S. Sadović, D. Lepley, E. Brocard, J. M. George

13. Current standard practice in EHV/HV Italian substation design: Oriented modelling and simulation of lightning protection system for improving design criteria

14. Surveillance of Lightning Strokes Near Transmission Lines
Andreas Wuerl, Hans D. Betz, Kersten Schmidt, Wolf P. Oettinger

15. Modeling of overhead transmission lines with line surge arresters for lightning overvoltages
M. Jaroszewski, J. Pospieszna, P. Ranachowski, F. Rejmund
16. The possibility of insulation level reduction on 110 kV overhead line with built-in post insulators using line surge arresters
S. Vižintin, I. Kobal, M. Bečan

17. Experience of Tyco & Antamina in the Lightning Performance and Reliability Improvement of 220 kV Transmission Lines in Peru
Jorge Luiz De Franco, Craig Sutton, Carlos Riva, Jorge Tuesta Rivera, Jose Francisco Montes, Wilson Alonzo, Mussolini Tarazona, Manuel Contreras

18. Improvement of the transmission and sub transmission overhead lines lightning performance using line arresters – Experience in Brazil
Jorge Luiz De Franco, José Pissolato Filho

19. Reduction of the visual impact of overhead transmission line systems through utilization of line surge arresters as lightning protection
T. K. Soerensen, J. Holboell

20. Case Study for Application of Transmission Line Arresters on Croatian 400 kV Line along the Adriatic Coast Mountains
L. Klingbeil, Z. Baus, S. Nikolovski, I. Ivanković

21. Lightning performance improvement of 110 kV line Ston – Komolac by use of line surge arrester
M. Puharić, M. Mesić, M. Lovrić, J. Radovanović, S. Sadović

22. Line surge arresters applications on the multi circuit overhead lines
S. Sadović, T. Sadović
| 23. | Line arrester application on a 110 kV high alpine overhead line to reduce lightning-caused outages  
T. Judendorfer, S. Pack, M. Muhr |
| 24. | Romanian Field Experience In Mounting And Exploitation of Line Arresters On High Voltage Overhead Electric Lines  
Stelian Alexandru Gal, Traian Fagarasan, Marius Oltean, Constantin Matea |
| 25. | Performance of parallel surge arresters  
A. Haddad, H. Griffiths, M. Osborne |
| 26. | Testing Requirements and actual IEC Work on Transmission Line Arresters  
Volker Hinrichsen |
| 27. | Design Features and Performance of Gapped Transmission Line Arresters  
Makoto Yamaguchi, Hiroki Kajino, Hiroki Saito, Shinji Ishibe |
Masaru Ishii, Hiroyuki Kado, Kazuhiro Shimoda, Kenji Tsuge, Katsuki Komatsu, Makoto Yamaguchi, Hideto Watanabe, Takeshi Iwaida, Takehiko Akedani, Hiroshi Kohno |
| 29. | Specific Consideration on Follow Current Interruption and Anti-pollution Performance of External Series Gapped Type Line Surge Arrester (EGLA)  
Yoshihiro Ishizaki, Kenji Tsuge, Misao Kobayashi, Kunikazu Izumi |
| 30. | Calculations of lightning-induced voltages in distribution lines with LSA  
P. E. Munhoz Rojas, C. L. da S. Pinto |
| 32. | Lightning Phenomena and Related Accidents to Humans | G. Berger |
| 33. | Line Arresters on Distribution Lines in Hilly Regions | A. Sekso, I. Sekso, J. Trbus |
| 34. | Brazilian production development of class 2 polymeric surge arresters for transmission line application (TLA) | A. A. Dellallibera, A. D. Andrade, A. C. Guará Bezerra, J. V. P. Duarte, P. M. B. Góis, R. L. Markiewicz |
| 35. | Lightning Protection Of Electric Power Overhead Distribution Lines by Long–Flashover Arresters in Russia | G. V. Podporkin, E. S. Kalakutsky, V. E. Pilshikov, A. D. Sivaev |
| 37. | Mapping Lightning Thunderstorms for Saudi Arabia for Better Selection of Ground wires and Lightning Arresters | M. H. Shwehdi |
| 38. | First Experience in Monitoring of Line Surge Arresters Installed on 110 kV Transmission Line Ston – Komolac in Croatia | S. Bojić, I. Dolić, A. Sekso, J. Radovanović, D. Škarica |
## 10. TIME–TABLE

**INTERNATIONAL COLLOQUIUM**

Application of Line Surge Arresters in Power Distribution and Transmission Systems  

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<tr>
<th><strong>Sunday, May 25</strong></th>
<th>hall</th>
<th><strong>Monday, May 26</strong></th>
<th><strong>Tuesday, May 27</strong></th>
<th><strong>Wednesday, May 28</strong></th>
<th><strong>Thursday, May 29</strong></th>
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<td>10.00 a.m. – 5.00 p.m.</td>
<td>IEC TC37 MT4 Meeting</td>
<td>2000 a.m. – 10.30 a.m.</td>
<td>Opening Ceremony + Invited Lecture I.</td>
<td>9.00 a.m. – 10.30 a.m.</td>
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<td>6.30 p.m. – 7.30 p.m.</td>
<td>Welcome Cocktail Party</td>
<td>10.30 a.m. – 11.00 a.m.</td>
<td>Coffee Break</td>
<td>10.30 a.m. – 11.00 a.m.</td>
<td>10.30 a.m. – 11.00 a.m.</td>
<td>9:00 a.m. – 1.00 p.m.</td>
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<td>10.00 a.m. – 5.00 p.m.</td>
<td>IEC TC37 MT4 Meeting</td>
<td>11.00 a.m. – 11.45 a.m.</td>
<td>Invited Lecture II.</td>
<td>11.00 a.m. – 11.45 a.m.</td>
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<td>Invited Lecture III.</td>
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<td>Session – part I. (Topic 1)</td>
<td>2.30 p.m. – 3.00 p.m.</td>
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PAPERS PRESENTATIONS:

Monday, May 26  2.30 p.m. – 4.00 p.m. Session – part I. (Topic 1)

Paper 32:  
Lightning phenomena and related accidents to humans  
(G. Berger)

Paper 5:  
Decreasing Backflashover Numbers on Medium Voltage Overhead Lines Located in Regions with High Soil Resistivity  
(D. Mišković, I. Uglešić)

Paper 13:  
Current Standard Practice in EHV/HV Italian Substation Design: Oriented Modelling and Simulation of Lightning Protection System for Improving Design Criteria  

Paper 16:  
The Possibility of Insulation Level Reduction on 110 kV Overhead Line with Built-in Post Insulators Using Line Surge Arresters  
(S. Vižintin, I. Kobil, M. Bečar)

Paper 20:  
Case Study for Application of Transmission Line Arresters at Croatian 400 kV Line Along the Adriatic Coast Mountains  
(L. Klingbeil, Z. Baus, S. Nikolovski, I. Ivanković)

Paper 33:  
Line arresters on distribution lines in hilly regions  
(A. Sekso, I. Sekso, J. Trbus)

Monday, May 26  4.30 p.m. – 6.00 p.m. Session – part II. (Topics 3 and 10)

Paper 12:  
Line Surge Arresters Applications on the Compact Transmission Lines  
(S. Sadović, D. Lepley, E. Brocard, J. M. George)

Paper 19:  
Reduction of the visual impact of overhead transmission line systems through utilisation of line surge arresters as lightning protection  
(T. K. Soerensen, J. Holboell)

Paper 22:  
Line Surge Arresters Applications on the Multi Circuit Overhead Lines  
(S. Sadović, T. Sadović)
Paper 11:
Real–Time Remote Monitoring of Line Surge Arresters
(M. Muhr, T. Sadović)

Paper 38:
First Experience in Monitoring of Line Surge Arresters Installed on 110 kV Transmission Line Ston – Komolac in Croatia
(S. Bojić, I. Dolić, A. Sekso, J. Radovanović, D. Škarica)

**Tuesday, May 27**

9.00 a.m. – 10.30 a.m. Session – part I. (Topics 4 and 8)

Paper 6:
Pilot Study on the Use of Gapless Transmission Line Arresters (TLA) as an Alternative to Gapped TLA in TNB Transmission System
(Iryani M. Rawi, M. Pauzi Yahaya)

Paper 27:
Design Features and Performance of Gapped Transmission Line Arresters
(Makoto Yamaguchi, Hiroki Kajino, Hiroki Saito, Shinji Ishibe)

Paper 1:
Installation of LSA on a 400 kV Double–circuit Line in Russia
(L. Stenström, J. Taylor, N.T. Osiptsov, F. Persson)

Paper 9:
Application of Gapless Surge Arresters for Lightning Protection of Transmission and Distribution Lines
(M. G. Comber)

**Tuesday, May 27**

11.00 a.m. – 1.00 p.m. Session – part II. (Topics 7 and 6)

Paper 7:
Evaluation of Energy Stress on Line Arresters
(I. Uglešić, V. Milardić, B. Filipović–Grčić, A. Tokić)

Paper 2:
Application of ANN and Genetic Algorithm for Evaluation the Optimum Location of Arresters on Power Networks due to the Switching Overvoltages
(Reza Shariatinasab, Behrooz Vahidi, Seyed Hossein Hosseinian, Akihiro Ametani)

Paper 15:
Modeling of overhead transmission lines with line surge arresters for lightning overvoltages
(M. Jaroszewski, J. Pospieszna, P. Ranachowski, F. Rejmund)
Paper 30:
Calculations of lightning–induced voltages in distribution lines with LSA
(P. E. Munhoz Rojas, C. L. da S. Pinto)

Wednesday, May 28  9.00 a.m. – 10.30 a.m. Session – part I. (Topic 2)

Paper 3:
Reduction of the double–circuit flashovers on a 400 kV overhead line

Paper 4:
Line Surge Arresters Potential Applications on Hydro–Québec TransÉnergie Transmission System
(P. Prud’homme, A. Dutil)

Paper 14:
Surveillance of Lightning Strokes Near Transmission Lines
(Andreas Wuerl, Hans D. Betz, Kersten Schmidt, Wolf P. Oettinger)

Paper 35:
Lightning Protection of Electric Power Overhead Distribution Lines by Long–Flashover Arresters in Russia
(G. V. Podporkin, E. S. Kalakutsky, V. E. Plishikov, A. D. Sivaev)

Wednesday, May 28  11.00 a.m. – 1.00 p.m. Session – part II. (Topics 2 and 5)

Paper 36:
On the Mitigation Effect of Surge Arresters on the Lightning Performance of Overhead Distribution Lines
(A. Borghetti, F. Napolitano, C. A. Nucci, M. Paolone)

Paper 37:
Mapping Lightning Thunderstorms for Saudi Arabia for Better Selection of Ground wires and Lightning Arresters
(M. H. Shwehdi)

Paper 10:
Basic Study on Deterioration of Transmission Line Arresters
(N. Yamada, M. Nakagami)

Paper 25:
Performance of Parallel Surge Arresters
(A. Haddad, H. Griffiths, M. Osborne)
Paper 26:
  Testing Requirements and Actual IEC Work on Distribution and Transmission Line Arrester
  (V. Hinrichsen)

C. A. Nucci: Ongoing activities in Insulation coordination within SC C4

**Thursday, May 29 9.00 a.m. – 10.30 a.m. Session – part I. (Topics 5 and 8)**

Paper 29:
  Specific Consideration on Follow Current Interruption and Anti-pollution Performance of External Series Gapped Type Line Surge Arrester (EGLA)
  (Yoshihiro Ishizaki, Kenji Tsuge, Misao Kobayashi, Kunikazu Izumi)

Paper 34:
  Brazilian production development of class 2 polymeric surge arresters for transmission line application (TLA)
  (A. A. Dellalibera, A. D. Andrade, A. C. Guará Bezerra, J. V. P. Duarte, P. M. B. Góis, R. L. Markiewicz)

Paper 8:
  Application of Line Surge Arresters in Power Transmission Line in China
  (ZHANG Cui-xia, FAN Jian-bin, GE Dong, CHEN Xiu-juan)

Paper 17:
  Experience of Tyco & Antamina in the Lightning Performance and Reliability Improvement of 220 kV Transmission Lines in Peru
  (Jorge Luiz De Franco, Craig Sutton, Carlos Riva, Jorge Tuesta Rivera, Jose Francisco Montes, Wilson Alonzo, Mussolini Tarazona, Manuel Contreras)

Paper 18:
  Improvement of the transmission and sub-transmission overhead lines lightning performance using line arresters – Experience in Brazil
  (Jorge Luiz De Franco, José Pissolato Filho)

**Thursday, May 29 11.00 a.m. – 12.30 p.m. Session – part II. (Topic 8)**

Paper 21:
  Lightning Performance Improvement of 123 kV Line Ston – Komolac by Use of Line Surge Arresters
  (M. Puhařić, M. Mesić, M. Lovrić, J. Radovanović, S. Sadović)

Paper 23:
  Line Arrester Application on a 110 kV High Alpine Overhead Line to reduce Lightning-Caused Outages
  (T. Judendorfer, S. Pack, M. Muhr)
Paper 24:
Romanian Field Experience in Mounting and Exploitation of Line Arresters on High Voltage Overhead Electric Lines
(Stelian Alexandru Gal, Traian Fagarasan, Marius Oltean, Constantin Matea)

Paper 28:
Lightning Protection of Overhead Transmission Lines with Surge Arresters – Development of Line Arresters and the Technology in Japan
(Masaru Ishii, Hiroyuki Kado, Kazuhiko Shimoda, Kenji Tsuge, Katsuaki Komatsu, Makoto Yamaguchi, Hideto Watanabe, Takeshi Iwaida, Takehiko Akedani, Hirotoshi Kohno)

Paper 31:
Application of line surge arrester on a 230 kV transmission line CEMIG's Experience
11. REGISTRATION AND INFORMATION OFFICE

All participants should register immediately after arrival at HRO CIGRÉ Registration and Information Office (in front of the hall Orlando) where they will receive all conference materials and information regarding the Colloquium.

12. INFORMATION FOR SPEAKERS AND TECHNICAL EQUIPMENT

Authors will have available 10–12 minutes for their presentations and a few minutes for discussions. Please limit your presentation to approximately 10–15 slides. Authors are kindly requested to be present in the Orlando hall 15 minutes before the scheduled session in order to receive final information and instructions from the session chair.

Orlando hall will be equipped with:

- DATA projectors (DATASCOPE) for computer presentation (resolution up to 1024 x 768 pixels)
- Video projections (DVD)
- Notebook or PC with Windows XP operating system and Microsoft Office 2007

Authors should bring their Power Point presentations 15 minutes before the beginning of the session on CD–ROM or USB memory stick. Version MS PowerPoint 2003 is recommended. The technical support will be available. Colloquium Staff will make sure that your presentation is downloaded on the computer. A technician or a hall attendant will be in Orlando hall to provide assistance when needed. If you have questions, please contact your chair or a staff member it the Orlando hall.
13. TECHNICAL VISIT/Wednesday, May 28, 2008

Dress code: casual

Technical Visit to the Overhead Line 110 kV Ston – Komolac (Pole No. 38)

– Bus departure in front of the Croatia Hotel in Cavtat 3.00 p.m.
– Bus journey across the bridge and along the coastal road; arrival at the Pole 38 location (60 km) 3.00 p.m. – 4.00 p.m.
– Presentation of the main features of the overhead line and initial experiences with the pilot project for application of line surge arrester 4.00 p.m. – 4.10 p.m.
– Viewing of the location – Pole No. 38 and installed line surge arresters, panoramic view of the Pelješac Peninsula; taking photographs 4.10 p.m. – 4.20 p.m.
– Return by bus along the coastal road to the Gruž harbour 4.20 p.m. – 5.30 p.m.

Dinner

Option 1:

– Embark on m/s Tirena 6.00 p.m. – 10.00 p.m.
– leisure cruise along the city walls of Dubrovnik to the nearby island of Lokrum– the ship will be anchored in the Portoč Bay and dinner will be served on boat; during the dinner the guests will be entertained by a Dalmatian vocal band
– return cruise to Cavtat after dinner

Option 2:

– In case of bad weather conditions 6.00 p.m. – 10.00 p.m.
– after the technical visit (6.00 p.m.), coach transfer to Dubrovnik; dinner will be organized at The Mimoza restaurant – a newly renovated restaurant is located at Pile, just outside Old Town Dubrovnik and across Hilton Hotel; after dinner transfer back to the hotel by coach
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Key figures
• 4 billion euros turnover in 2005
• 8,300 employees
Key Features

- HV arrester suspended from a transmission line giving enhanced transmission line performance.
- Increasing system line voltage on standard insulated transmission lines.

Benefits of TLA Installations

- Minimising circuit breaker operation with possible system outage resulting from back flashover on the transmission line.
- Switching overvoltages are absorbed over the length of the line reducing the severity of surge at the substation.
- Transmission systems can be operated even where sub-soil gives poor tower footing resistance.
- Eliminating interrupted supply for power supply for sensitive industrial processes.
- Installing Transmission Line Arresters on a standard 3 phase voltage system along the line, at calculated intervals, allows for optimum performance of the TLA, to give an increased system line voltage. Therefore eliminating the need to increase the standard insulation level required on conventional system upgrade.
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