Resume

Name Ravindra Arora

Date of Birth July 15, 1943

Address Professor, Department of Electrical Engineering
Indian Institute of Technology Kanpur – 208016
India

Telephone +91-512 – 2597665 (0), 2590339 (R) & 2598611 (R)

Fax +91-512 – 2590063

e-mail rarora@iitk.ac.in

Website http://www.iitk.ac.in/ee/faculty/raviarora.shtml

Qualifications

Academic Dr.-Ing. from TU Dresden, Germany, 1973;
B.Sc. (Eng.) from BIT Mesra, Ranchi, India 1965.

Professionals Senior Member of IEEE(for the last 19 years);
Chairman, IEEE UP Section, India for the years 1998 & 99;
Fellow Institution of Engineers (India)

Appointments

Regular

- Emeritus Fellow, Indian Institute of Technology, July 2006-08.
- Professor, Indian Institute of Technology, Kanpur, March 1991-June 2006.
- Assistant Professor, Indian Institute of Technology, Kanpur, from August 1977 to February 1991.
- Lecturer, Indian Institute of Technology, Kanpur, from August 1974 to July 1977.
- Assistant Engineer, Universal Cables Ltd., Satna, India from Nov.1965 to Nov.1966 for one year.

Visiting

- Research Fellow at High Voltage Engineering Department, Technical University, Dresden, Germany in 1987 and in 1989 for a year.
- Associate Professor at Electrical Engineering Department, Al-Fateh University, Tripoli, Libya for two years during 1985 to 1987.

- Research Advisor at Raghvendra Industrial Research Foundation and Industrial Cables (India) Ltd., Rajpura, Punjab for one year in 1978.

Field of Interest:

High Voltage and Insulation Engineering is my main field of interest. I have been actively involved in research, education and consultancy/testing in this field.

Special Field of Interest:

My special field interest is Lightning and Ball Lighting, their deleterious effects and protection. It has associated me with a large number of investigations of cases where severe blast occurred due to lightning strike. In the year 2002 the mystery of wide scale occurrence of Ball Lighting in northern India was revealed by my investigations. I am actively involved in research for understanding lightning phenomenon and its protection through experimental investigations and consultancy. I have delivered many lectures on this subject in India and abroad.

Teaching experience & contributions

(i) **Duration:** Thirtyfour years.

(ii) **Courses developed:** I have introduced and developed the following courses at IIT Kanpur, which are being offered regularly:

1. EE 638 - A PG level course on "High Voltage Insulation Engineering Behaviour of Dielectrics".

2. EE 437 - An undergraduate elective course involving six laboratory experiments on "Fundamentals of HV Engineering and Laboratory Techniques".

3. EE 432 - An open elective on the production of electrical power from conventional and renewable sources of energy, "Power Generation and Utilization".

(iii) **Other Courses taught:**

1. EE 637 - HVAC Transmission (Steady State and Transient Over Voltages in HV Transmission).

2. EE 630 - Power System Dynamics (Stability and Synchronous Machine Modeling).

3. EE 436 - Power System Engineering (Switchgear, protection and Power Cables).

4. EE 431 - Power System Analysis (a compulsory course introducing T&D).

5. EE 380 & EE 381 - Electromechanical Energy Conversion I & II and (Laboratory course on Electrical Machines).

6. ESc 210 – Introduction to Electrical Engineering.

7. M 101 - Mathematics I (Tutor).

(iv) **Courses taught at Al-Fateh University, Tripoli, Libya:**

During my stay of six trimesters there from 1985 to 1987 (three semesters in an academic year), I taught seven different courses on power systems, electrical machines, high voltage engineering and electrical science.

(v) **Ph.D. theses guided:**

1. "Investigation of Insulating properties of Vacuum under High Voltage" by Md. Abdul Goffar Khan, December 1995, IIT Kanpur.

2. "Classification of Partial Discharge Patterns using Texture Analysis Algorithms" by Md. Kamal Abdul El-Rahman, June 1999.

(vi) **M.Tech. theses guided:**

1. Investigation of Air Gap Clearance required for Electric Traction, by Nagaraju Madallapalli, Jun 2007, IIT Kanpur.

2. Performance Evaluation of Ceramic Insulators under Pollution with and without RTV Coating, by Satyendra Kumar Yadav, May 2006, IIT Kanpur.

3. Elecric Field Distortion and Stress Control at the Crossing of Transmission Lines, by Amit Singh, May 2006, IIT Kanpur.

4. To investigate the breakdown characteristics of atmospheric air with varying degree of uniformity in extremely nonuniform fields with dc and ac voltages, by Daya Shankar Chaubey, Sep 2003, IIT Kanpur.

5. Development of an ozonator adopting surface discharge technique, by Pankaj Kumar Meena, Jun 2003, IIT Kanpur.

6. Experimental investigation of performance of 400 kV line insulators under pollution, by Manoj Rai, January 2003, IIT Kanpur.

7. Effect of Ultra-Violet Irradiation on XLPE Cable Insulation, by Vikas Tripathi, Dec 2002, IIT Kanpur.

8. Study of the Effect of Degree of Uniformity of the field on breakdown strength of air in weakly nonuniform field configuration with lightning and switching impulse voltages, by Kishore Vaibhav, Jul 2002, IIT Kanpur.

9. Experimental investigations of electrically stressed droplets on insulating surfaces, by Balarko Chaudhuri, Dec 2001, IIT Kanpur.

10. Study of lightning effects and protection of electronic equipments, by Ajay Jangid, Dec 2001, IIT Kanpur.

11. Investigation of the effect of Laser on the breakdown strength of atmospheric air with lightning impulse voltage, by Sudhir Kumar Singh, May 2001, IIT Kanpur.

12. Treatment of SO_2 in Flue Gas using a new method of corona by Surface Discharge, by Mukul Agarwal, May 2001, IIT Kanpur.

13. An investigation of Partial Discharge inception voltage in air and SF_6 gas, by Partha Haldar, Dec.2000, IIT Kanpur.

14. Experimental investigation of electrical properties of Ambient Plasma, by Banwari, April 2000, IIT Kanpur.

15. Breakdown Properties of atmospheric air for short gap Diatances in Extremely Non uniform field with switching and lightning impulse voltages, by Jagdish Choudhary, April 2000, IIT Kanpur.

16. Breakdown Properties of atmospheric air with Switching Overvoltages, by Surendra Singh, July 1998, IIT Kanpur.

17. Investigation of lightning protection, by N.K Verma, March 1996, IIT Kanpur.

18. Digital computation of Continuous Current Carrying Capacity of Cables, by Kishore, July 1994, IIT Kanpur.

19. An investigation of the effect of Pre-Ionization on the lightning protection air Terminal, by Major Daver, April 1994, IIT Kanpur.

20. An investigation of the Schwaiger Factor Limit in air, by Sunil Prem, April 1994, IIT Kanpur.

21. Investigation of lightning Strikes, by Rajiv Sawhney, April 1993, IIT Kanpur.

22. Investigation of insulating properties of low vacuum in weakly nonuniform fields for ac power frequency and switching impulse voltages, by Shyam Sunder Gupta, October 1992, IIT Kanpur.

23. Investigation of insulating properties of low vacuum in extremely nonuniform field configurations by ac power frequency voltage, by Manish Kumar Agrawal, September 1992, IIT Kanpur.

24. An investigation of electromagnetic interference caused by different types of coronas in air, by R.K Srivastava, May 1991, IIT Kanpur.

25. Application of charge Simulation Method (CSM) for the Estimation of High Voltage Fields, 1990, by Ajay Arora, IIT Kanpur.

26. Measurement of HV by Chubb and Fortescue method, 1987, Al-Fateh University, Libya.

27. Suitability of Power cables for nuclear power plants, by MGQ Badshah, 1985, IIT Kanpur.

28. Study of switching overvoltages on transmission lines, by Prodip Kumar Chowdhary,1984, IIT Kanpur.

29. Analysis for design of EHV and UHV 3-phase and 6-phase lines based on Electrostatic Field, Audible Noise and Radio Noise, by J. Senthil, 1984, IIT Kanpur.

30. Development of a digital peak voltmeter for the measurement of power frequency high voltage, by Ashish Kumar Nandi, 1984, IIT Kanpur.

31. Estimation of radio interference from corona discharge on EHV transmission lines, by Sachichidanand, 1977, IIT Kanpur.

32. Life tests on PE cables, 1972, TU Dresden, Germany.

Industrial experience

Worked directly on the shop floor for three and a half years;

- Worked as Assistant Engineer for one year during 1966 with Universal Cables Ltd., Satna (M.P.) for the Production and Quality Control of Power Cables upto 11 kV.

- Had Vocational Training for one and a half years during 1967-68 at Kabelwerk Oberspree, Berlin, Germany in the production and R&D of HV power cables upto 110 kV.

- Worked with Industrial Cables (India) Ltd., Rajpura, Punjab for one year during 1978 in Quality Control and Development. They produced cables upto 33 kV at that time.

R&D facilities developed and research contributions

Right from the beginning of my professional career, I have been associated with some laboratory either in industry or in educational institution. These are HV testing laboratory at Universal Cables, Satna (1966) and Kabelwerk Oberspree, Berlin (1967-68). During my Ph.D. work at TU Dresden, Germany, worked in their HV and Heavy Current laboratories (1969-73). Also developed R & D and testing facilities at Raghvendra Industrial Research Foundation, Rajpura (Punjab) during 1978.

A unique HV laboratory has come up at IIT Kanpur during last two and a half decades which has been planned, designed, erected and commissioned by me. This facility extends both, indoor as wall as outdoor test bay with the help of a wall bushing. This laboratory has a Partial Discharge (PD) free 100 kV, 50 kVA, ac testing transformer, a 500 kV, 4.4 kJ Impulse Generator having facility to produce lightning as well as switching surges and a 400 kV dc test set. A number of instruments like PD detector, Schering Bridge for tanδ, Insulation Resistance meter (Mega Ohm meter), Guardring capacitor for liquid dielectrics and pressure vessel for vacuum and gaseous dielectrics facilitate a variety of measurements on solid, liquid and gaseous dielectrics. This has emerged as a unique HV laboratory facility in northern India and it is effectively utilized for education, research and industrial testing purposes.

My R & D contributions have been on the detection and evaluation of Partial Discharges, effects of dynamic short circuit forces in power cables, life expectancy of power cables, suitability and product development of polymer cables especially for nuclear power plants, EMI due to corona, HV performance of vacuum insulation, performance of line insulators, under pollution, ambient plasma and lightning phenomenon and protection.

Knowledge of German language

Can fluently read, write and speak German. Passed highest examination in German language from Herder Institute, Leipzig, Germany in 1971. Ever since, I am in continuous touch with German language. I have been receiving and referring technical journals and books, writing articles, assisting colleagues and students for any problems in German language. I have also made frequent visits to Germany.

Research projects and consultancy work

Actively involved in providing consultancy services to many large industrial organizations and small entrepreneurs for their product development and problems with high voltage insulation. I have been member of the Technical Advisory Committee of Industrial Cables (India) Ltd., Rajpura (Punjab) for more than a decade. I have provided consultancy services to National Thermal Power Corporation (NTPC), Bharat Heavy Electricals Ltd. (BHEL), U P State Electricity Board (UPSEB), Power Grid Corporation, India Insulators Ltd., Cawnpore Woolen Mills, RDSO (Indian Railways R & D Organization), ONGC Ltd. of India etc. as and when required. I am consultant to UP State Industrial Development Corporation Ltd. (UPSIDC) for their power distribution installations in industrial and housing sectors. A considerable amount of testing work of transformers, cables, electrical instruments and dielectric materials is undertaken in our high voltage laboratory under my guidance.

Major Project Involvement:

1 Principal Investigators of the project " Review of electrical clearance in air for 25 kV, 50 Hz ac overhead electric Traction system of Indian Railways, sponsored by RDSO Lucknow. This two year project was completed in March 2005. The recommendations for the clearance made through this projected were implemented by the Indian Railway Specifications in 2007.

2 Project coordinator of, "Development of remote operated 11 kV Load Break Switch and Low Voltage Moulded Case Circuit Breakers". This is a part of the Technology Development and Transfer Mission Project on "Distribution Automation". The aim is to develop efficient and reliable management of distribution of power. The technology development part of this project is over and its field implementation is in progress.

3 The consultancy project on the feasibility study and design of "Lightning protective System for Crude Oil Tank and Slop Tank" with Oil and Natural Gas Corporation Ltd. of India, Panvel, Navi Mumbai has been completed in 1999.

4 Member of the Standing Committee on Engineering and Communication for Indian Antarctic Expeditions, Department of Ocean Development of Government of India.

Organization of refresher courses and conferences

Principal coordinator of short term winter schools on "High Voltage Transmission, Laboratory and Dielectric Techniques" (Dec 1982) and "Problems of EHV Transmission including Transient Performance" (Dec 1984) each for two weeks. Both these courses were organized under Quality Improvement Program of Government of India.

I have been member of the Technical Review/Organizing Committee/Advisory Committee of the following conferences:

1. 12th International Symposium on High Voltage Engineering, August 2001 (ISH–2001), Bangalore, India.

2. IEEE TENCON 2000, on "Intelligent Systems and Technologies for the next Millennium", Sept. 2000, Kuala Lumpur, Malaysia.

3. Modern Trends in the Transmission Systems, 14th National Convention of Electrical Engineers, Dec.'98, IIT Kanpur.

4. National Symposium on "Recent trends in Signals and Systems", Oct.'98, IIT Kanpur.

5. All India Symposium on "Applications of Signal Processing" (ASP'98) IE (India) Lucknow, Sept.'98.

6. Ninth National Power Systems Conference '96, (IIT Kanpur).

7. Power Electronics, Drives and Energy Systems for Industrial Growth '96 (IEEE International Conference at New Delhi).

8. Third Workshop and Conference on EHV Technology '95 (Indian Institute of Science, Bangalore).

9. Seventh National Systems Conference '93 (IIT Kanpur).

Contributions in professional and community services

Nominated as University Grants Commission (UGC) expert committee member for the review of their Special Assistance Program of DRS level at the Department of High Voltage Engineering, IISc, Bangalore, March 2000 and for their COSIST Program, Feb. 2001.

I am have been member of Selection/PhD and evaluation committees at Indian school of Mines University Dhanbad, Indian Institute of Science Bangalore, IIT Kharagpur, Anna University Madras, Banaras Hindu University Institute of Technology Varanasi, Ministry of Science and Technology, Union Public Service Commission New Delhi, Madhya Pradesh Public Service Commission Indore, UP Public Service Commission Allahabad etc.

In our institute, I have been taking active part in student affairs. I was Head of Placement for two years from July 2002-04, Head Counseling Service of the Institute from June 1994 to Dec 1996, Chairman, Council of Wardens (COW) 1983-84, Vice-Chairman of Graduate Aptitude Test in Engineering (GATE) 1984-85. I was convener of Department Under Graduate and Post Graduate Committees and in charge for setting the department academic timetable for several years.

I was a member of "Technical Advisory Committee (Electrical)", responsible for thedistribution of electric power supply in IIT Campus. I have been actively involved in theprocurement, testing and maintenance of the all power apparatus in service at 33/11/0.4 kV level at IIT Kanpur.

Publications

(i) Book:

"High Voltage Insulation Engineering" -Behavior of Dielectrics, their properties and Applications, Wiley Eastern, New Delhi (1995), reprint (1999), first advance level book in English describing the fundamentals and novel concepts of the subjectdeveloped in Germany.

This book is the outcome of the development of courses at TU Dresden and IIT Kanpur. It makes full use of rich German as well as English literature available in this particular field. Prof. Wolfgang Mosch of TU Dresden is the co-author. Another book on the same subject is under completion and expected to the published before the year 2010.

An advance level elective web course on High Voltage Engineering has been developed under the "National Programme on Technology Enhanced Learning".(NPTEL),of MHRD. It is a accessible at www.nptel.iitm.ac.in

(ii) Technical papers:

1. "Classification of Electric Fields and Field Dependent Behaviour of Dielectrics", High Voltage Workshop at 2008 IEEE International Power Modulator Conference, Las Vegas, Nevada, USA, May 27-31, 2008 (accepted for oral presentation).

2. Electrical clearance in Air for 25 kV, 50 Hz, ac, Overhead Electric Traction", 2008 IEEE International Power Modulator Conference and High Voltage Workshop, Las Vegas, Nevada, USA, May 27-31,2008 (accepted for poster presentation).

3. "Ball Lightning without Lightning Strike", Proceedings, 8th International Symposium on Ball Lightning, (ISBL04), National Central University, Chung-Li, Taiwan, Aug. 3-5, 2004 pp. 11-15.

4. “Effect of Ultra Violet irradiation on low voltage cable insulation”, Conference record, 2004 IEEE International Symposium on Electrical Insulation, Indianapolis, USA, Sept. 19-22, 2004, pp.358-361. Co-author Vikas Tripathi.

5. “Performance of 400 kV Line Insulators Under Pollution”, Conference Record, 2006 IEEE International Symposium on Electrical Insulation. Toronto, Canada, June 11-14, 2006, pp. 136-139, Co- author Manoj Rai and Satyendra Kumar Yadav.

6. “A new approach to the mechanism of lightning strike”, International Roundtable on Lightning Protection, Colombo, Sri Lanka, May 22-25, 2007 organised by National Science & Technology Commission, Colombo and NAM S&T Centre, New Delhi.

7. “Investigation of the inception of streamer corona in SF6 gas”, 12th International Symposium on High Voltage Engineering, 20th-24thAugust 2001, IISc Bangalore, India, co-author Partha Haldar.

8. “Investigation of the effect of polarity of switching and lightning impulse voltages on the performance of air for short gap distances in extremely nonuniform fields”, IX International Symposium on Gaseous Dielectrics, 21st-25th May, 2001, Ellicott City, Maryland, by NIST, USA, co-author Jagdish Choudhary.

9. “Partial discharge classification using principal component transformation”, IEE Proc.-Sci Meas. Technol., Vol. 147, No. 1, January 2000, co-author M.K Abdul Rahman and S.C Srivastava.

10. “Neural Network based partial discharge recognition” proceedings of 14th national convention of electrical engineering on modern trends in transmission system, IIT Kanpur, India, Dec. 1998, pp. 194-205, co-author M.K Abdul Rahman and S.C Srivastava.

11. “Classification of partial discharge pattern using texture analysis algorithm”, proceedings of international symposium on electrical insulation material, Toyohashi, Japan, Sept. 1998, pp. 573-576, co-author M.K Abdul Rahman and S.C Srivastava

12. “New techniques for partial discharge classification”, proceedings of 4th workshop and conference on EHV technology, Bangalore, India, July 1998, pp. 103-106, co-author M.K Abdul Rahman and S.C Srivastava.

13. "Traces of lightning incidences on structures", 24th International Conference on lightning protection, Birmingham 14th-18thSeptember 1998, organized by Staffordshire University, United Kingdom.

14. "Experimental Estimation of Schwaiger Factor Limit in atmospheric air", Eighth International Symposium on Gaseous Dielectrics, June 2-5, 1998, National Institute of Standards and Technology, Gaithersburg, MD, USA, coauthor Sunil Prem.

15. "Investigation of breakdown in vacuum with positive and negative lightning impulse voltages in weakly non uniform fields", 1998 IEEE International Symposium on Electrical Insulation, Washington DC USA, 7-10 June 1998, co-author Md. Abdul G. Khan.

16. "New Techniques for Partial Discharge Classification", Fourth Workshop and Conference on EHV Technology, Bangalore, India, July 1998, co-author Md. K. Abdul Rahman and S.C. Srivastava.

17. "Classification of Partial Discharge Pattern using Texture Analysis Algorithm", Proceeding of the International Symposium on Electrical Insulation Material, Toyohashi, Japan, Sept. 1998, co-author Md. K. Abdul Rahman and S.C. Srivastava.

18. "Neural Network Based Partial Discharge Recognition", proceeding of the 14th National Convention of Electrical Engineers on Modern Trends in the Transmission System, IIT Kanpur, Dec.1998, co-author Md. K. Abdul Rahman and S.C. Srivastava.

19. "Application of Charge Simulation Method (CSM) for the Estimation of Field between HV and Grounded Electrodes", 3rd Workshop & Conference on EHV Technology, IISc Bangalore, 2-4 Aug 1995, pp. 73-78, co-author M A G Khan.

20. "Investigation for a Suitable Shape of lightning Conductor air Terminal Electrode", Proceedings of Seventh International Symposium on Gaseous Dielectrics, Knoxville, Tennessee, USA, April 1994, Paper 49, co-author Rajiv Sawhney.

21. "An investigation of electromagnetic inferterence caused by different types of coronas in air", Conference record of the 1992-IEEE International Symposium on Electrical Insulation', Baltimore, Maryland, USA, June 7-10, 1992, pp. 287-290.

22. "Radiation effects on Power cables for Nuclear Power Plants", Presented at 1988 International Conference, American Nuclear Society/European Nuclear Society, Washington DC, USA, Oct.-Nov. 1988, co-author M.C.Q. Adirbadshah.

23. "ES Field, AN and RI of 400-1300kV lines existing and proposed for India and comparison of AN level of single phase and three phase Test Lines", Proceedings, Conference and Workshop on EHV Technology, Bangalore, Aug. 1984, organised by I.I.Sc. Bangalore, IE (India) and IEEE (USA), coauthor, Rakosh Das Begamudre, J. Senthil.

24. "Requirements of Power Cables suitable for Nuclear Power Plants", Seminar on HV Power Transmission and distribution Systems, New Delhi, May 1984, organized by Punjab Research Institute, Rajpura and Indian Standards Institution, New Delhi, co-author M.C.Q. Adirbadshah.

25. "Alternate sources of Energy, present state of development", Electrical India, Vol. XXII No. 21, Nov. 1982.

26. "Analytical Evaluation of Radio Interference Level of HVDC Transmission Lines", Proceeding, National Power Systems Conference, College of Engineering, Osmania University, Hyderabad, Dec. 1981, co-author Sachchidanand.

27. "Dynamic short circuit stressesin plastic insulated power cables", Elektrie 34 (1980) Haft 2, pp. 75-77, Germany (in German).

28. "Design and Planning of a suitable EHV/UHV facility for Northern India", Proceedings - 1, Symposium on Extra High Voltage Engineering, Testing Equipment and Techniques, University of Roorkee, Roorkee, Sept. 1980, coauthor S. Gupta.

29. "Semiconductive screening of XLPE insulated power cables", Proceedings, Seminar on crosslinked Polyethylene insulated power cables, National Cable Research Institute, Rajpura (Punjab), July 1979, co-author, M.S. Sukhija.

30. "Modern trends in the selection of type of power cables in power systems", Seminar on crosslinked Polyethylene insulated power cables, National Cable Research Institute, Rajpura (Punjab), July 1979, co-authors, M.S. Sukhija, N.K. Seth.

31. "Modeling Engineering Education for Future", National Seminar on Educating the Engineers of Future, Institution of Engineers (India), Bangalore, Jan. 1979, co-author M.S. Sukhija.

32. "Effect of short circuit currents on power cables", Electrical India, Vol. XVIII, No. 20, Nov. 1978. co-author K.M. Srivastava.

33. "Design problems and constructional development in 11 kV PVC cables", Electrical India, Vol. XVII, No. 2, Feb. 1978.

34. "Experience with tanδ measurement on impregnating compounds for power cables", Electrical India, Vol. XVIII, No. 13, July 1977, co-author, M.S. Sukhija, G.S. Srivastava.

35. "Power Perspective in context with underground and overhead transmission", Seminar on Cables and Conductors, Raghvendra Industrial Research Foundation, Cable Research Institute, Rajpura, (Punjab), Jan. 1977.

36. "Partial Discharge measurement in cables and its correlation with life expectancy", Proceedings, Conference on PD in Electrical Insulation, Institution of Engineers (India), Bangalore, April 1976.

37. "Development in plastic insulated power cables", Proceedings Conference on Electrical Insulation, Institution of Engineers (India), Bangalore, Nov. 1974.

38. "Partial Discharge in Dielectrics", Symposium on High Voltage Engineering, Indian Institute of Science, Bangalore, Aug. 1974 (to mark Silver Jubilee of HV Engineering Department).

References

1. **Prof. Dr.-Ing. habil. Wolfgang Mosch**
   Muenchner Platz,
   DRESDEN Germany
   Tel: 49-351-471 9968

2. **Prof. M. Ramamoorty**
   Director General,CPRI Bangalore (Retired)
   email: mrmoorty@gmail.com

3. **Prof. N.C. Mathur,** IIT Kanpur (Retired)
   email: mathur_madhur@yahoo.com