



**RATAN DAS, Ph.D., P.Eng.**

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### **TECHNOLOGY LEADER**

- ✓ Expertise in power system modeling, simulation, analysis, protection, automation and control
- ✓ Results-driven technology leader in power system transmission & distribution PAC solutions
- ✓ Contribution outcomes include new R&D center, products, solutions and intellectual property

### **Key Competencies**

- Strategy & Planning
- System Architecture
- Training/Education
- Technology/Project Evaluation
- System Specification
- Project Management
- Technology/Product/Solution Development
- System/Product Performance Analysis
- R&D Roadmap and Implementation

### **Tools**

- PSCAD
- RTDS
- ARENE
- ASPEN
- MATLAB
- MS Project

### **EXPERIENCE**

#### **icaPower LLC ([icapower.com](http://www.icapower.com))**

**2016 - Present**

##### **Founder and Member**

**2016 – Present**

Consulting utilities for technology roadmap creation & digital substation solutions, and DER and Microgrid integration. Developed a white paper on high impedance fault detection for a major US utility.

#### **ABB Inc. ([abb.com](http://www.abb.com))**

**1998 - 2016**

##### **Senior Principal Engineer - Distribution Automation**

**2012 – 2016**

Member of ABB's EPMV International Team of Experts, technology development for distribution automation products, solving complex customer/product issues and participated in IEEE and CIGRÉ activities.

- Coordinated research activities for future technologies and products for distribution protection and control
- Resolved a product performance issue with multi-million dollar exposure as a member of an international team

##### **R&D Manager - Distribution Automation**

**2008 - 2012**

Established and managed a state-of-the-art distribution automation product development center and delivered seven IEDs within agreed time and budget.

- Created and managed US DA R&D center and doubled the R&D budget between 2008 and 2012
- Built a strong R&D team and hired 22 people during 2010-2011
- Delivered eight products for protection and control system for Feeder, Recloser, Motor & Transformer
- Assisted product management & marketing for coordination with a customer for a key DOE smart grid project

##### **Principal Engineer - Distribution Automation**

**2004 - 2008**

##### **Principal Engineer - Substation Automation and Protection**

**2003 - 2004**

##### **Senior Engineer - Substation Automation and Protection**

**1998 - 2003**

Provided technical expertise for protection system product development and resolved customer issues.

- Lead the R&D effort for the high impedance fault detection system
- Developed new algorithms for transformer protection system and distribution system fault location
- Contributed to the improvement of generator, phase comparison & distance protection system
- Established, operated and managed a state-of-the-art real-time digital simulation laboratory
- Modeled the 500 kV transmission system of a major US utility in PSCAD for a protection system retrofit project
- Contributed to the reorganization of ABB's Utility Engineers Training Program and resolved numerous customer issues related to products and its applications

**University of Saskatchewan (usask.ca)****Research Assistant - Power Systems Research Group****1992 – 1997**

Conducted research on fault location as part of graduate studies.

- Developed a distribution system fault location solution and transmission line fault location software

**NTPC Limited (ntpc.co.in)****1981 - 1995**

**Deputy Chief Design Engineer - Power Systems** (Study Leave 1992 – 1995)

**1992 - 1995**

**Assistant Chief Design Engineer - Power Systems**

**1989 - 1992**

**Senior Design Engineer - Power Systems**

**1986 - 1989**

**Design Engineer - Substation Design**

**1982 - 1986**

**Executive Trainee - Electrical**

**1981 - 1982**

Contributed to the protection and control system procurement, engineering, commissioning and operation analysis for generation and transmission systems. Coordinated with 26 power utilities for bulk power time-of-the-day metering systems engineering and installation.

- Supervised eight projects on protection & control systems, and metering & oscillography systems
- Designed protection and control systems for seven projects
- Evaluated technical bids for one  $\pm$  140 MVar, 400 kV Static Var Compensator system
- Analyzed four major grid disturbances and suggested remedial measures
- Designed innovative protection and control systems for two 400 kV substations
- Assisted in commissioning of protection and control systems for two 400 kV lines and one 500 MW generator
- Prepared technical specification for a pilot project on substation automation

**STANDARD/GUIDE/REPORT CONTRIBUTIONS (Selected)**

- Chair, IEEE Power System Relaying and Control (PSRC) Working Group (WG):
  - H45: Guide for Centralized Protection and Control (CPC) Systems within a Substation **(2018-)**
  - K15: Report on Centralized Substation Protection and Control (2013-2017)
  - H4: Dual Logo COMTRADE Std IEEE C37.111-2013/IEC 60255-24:2013 (2005-2013)
- Vice-Chair, IEEE PSRC WG
  - J7: IEEE C37.101 Generator Ground Protection Guide (2000-2007)
  - I16 & I1: Report on Understanding Microprocessor-based Technology Applied to Relaying (2000-2009)
- Member, IEEE PSRC WG for development of Standard, Guide and Report
  - J17: PC37.102 Guide for AC Generator Protection **(2017-)**
  - J16: PC37.101 Guide for Generator Ground Protection **(2017-)**
  - C30: Report on Microgrid Protection Systems **(2016-)**
  - C29: Report on Testing Methods for Power Swing Blocking and Out of Step Tripping **(2016-)**
  - I30: IEEE PC37.235 Guide for the Application of Rogowski Coils used for Protective Relaying **(2016-)**
  - D28: IEEE PC37.230 Guide for Protective Relay Applications to Distribution Lines **(2013-)**
  - H11: Dual logo Synchrophasor for Power Systems Standard IEC/IEEE 60255-118-1 Ed.1 **(2013-)**
  - H23: PC37.248 Guide for Common Format for Naming Intelligent Electronic Devices (COMDEV) **(2012-)**
  - H26: Report on COMTRADE 2013 Conformity Test Plan (2013-2015)
  - C7: IEEE C37.233 Guide for Power System Protection Testing (2004-2009)
  - D5: IEEE C37.230 Guide for Protective Relay Applications to Distribution Lines (2002-2008)
  - I15: IEEE C37.110 Guide for the Application of Current Transformers used for Protective Relaying (2000-2007)
  - H8: IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files (2004-2007)
  - J4: IEEE C37.102 Generator Protection Guide (2000-2006)
  - J6: Report on Performance of Generator Protection During Major System Disturbances (1999-2004)
  - D10: Report on EMTP Reference Models for Transmission Line Relay Testing (1999-2004)

- Member of CIGRÉ Working Group (Output - Technical Brochure):
  - B5.60: Protection, Automation & Control Architectures with Functionality Independent Hardware **(2017-)**
  - B5.63: Protection, Automation and Control System Asset Management **(2017-)**
  - B5.64: Methods for Specification of Functional Requirements of Protection, Automation & Control **(2017-)**
  - B5/C4.61: Impact of Low Inertia Network on Protection and Control **(2017-)**
  - B5.52: Analysis and comparison of fault location systems in AC power networks **(2013-)**
  - C4.24: Power Quality & EMC issues with future electricity networks **(2013-)**
  - C4.34: Application of PMUs for Monitoring Power System Dynamic Performance (2013-2017)
  - B5.94: High Impedance Fault Detection (2006-2008)

### **HONOR & AWARD (Selected)**

- IEEE PES Technical Committee (PSRC) Distinguished Individual Service Award "For Contributions to the Power Systems Industry and the revision and promotion of the COMTRADE 2013 Std. C37.111/IEC60255-24", **2017**.
- IEEE PES Prize Paper Award for the IEEE Transactions on Power Delivery paper by PSRC WG K15, "Advancements in Centralized Protection and Control within a Substation", **2017**.
- IEEE PES Technical Committee (PSRC) Prize Paper Award for the IEEE Transactions on Power Delivery papers:
  - "Advancements in Centralized Protection and Control within a Substation", WG K15, **2016**,
  - "Performance of Generator Protection During Major System Disturbances", WG J6, **2004**.
- Certification of Appreciation from the IEEE PES Technical Committee (PSRC):
  - Service as Chair of WG K15 – Report on Centralized Substation Protection and Control, **2017**
  - Service as Chair of WG H4 – Revision of C37.111 COMTRADE Standard, **2013**.
- Certification of Appreciation from the IEEE-SA Standards Board for contribution to the development of:
  - C37.110 Guide for the Application of Current Transformers, **2008**,
  - C37.101 Guide for Generator Ground Protection, **2007**.

### **TRAINING AND EDUCATION**

- Maximizing Your Leadership Potential, Center for Creative Leadership, Greensboro, NC, USA, 2011
- Ph.D. and M.Sc. in Electrical Engineering, University of Saskatchewan, Saskatoon, Canada, 1998 & 1995
- Bachelor of Electrical Engineering, Jadavpur University, Kolkata, India, 1981

### **AFFILIATIONS**

- Senior Member-IEEE; Member-CIGRÉ; Member IEEE PES and IEEE PSRC
- P.Eng., Association of Professional Engineers & Geoscientists of Saskatchewan (APEGS), Canada

### **WORKSHOP/SEMINAR/KEYNOTE/WEBINAR**

#### **Workshop**

- R. Das, "Looking into the Future Protection, Automation and Control Systems", IEEE Power System Relaying Committee (PSRC) Working Group K15 Presentation, 14th International Workshop on Electric Power Control Centers (EPCC 14), Wiesloch, Germany, May 14-17, 2017.
- R. Das, V. Madani, A.P. (Sakis) Meliopoulos, "Microgrid Deployment to Benefit DER Integration", i-PCGRID workshop, San Francisco, CA, USA, March 29-31, 2017.
- R. Das and A.P. (Sakis) Meliopoulos, "Looking into the Future Protection, Automation and Control Systems", IEEE Power System Relaying Committee (PSRC) Working Group K15 Presentation, i-PCRID workshop, San Francisco, CA, USA, March 30-April 1, 2016.
- R. Das, "Protection and Control Strategies for Distribution Automation in a Smart Grid", The 12th International Workshop on Electric Power Control Centers, Bedford Springs, PA, USA, June 2-5, 2013.
- R. Das, "Future of Distribution Automation", i-PCGRID workshop, San Francisco, CA, USA, March 26-28, 2013.

### Seminar

- "Centralized Substation Protection and Control (CPC) Application in Enabling DER Integration Using Asynchronous Microgrids", Clemson University, Clemson, SC, USA, April 27, 2017.
- "Looking into the Future Protection, Automation and Control Systems", IEEE Power System Relaying Committee Working Group K15 on Centralized Substation Protection and Control, nine locations in the US, The Netherlands and India, 2016-2017.
- "Centralized Substation Protection and Control in a Smart Grid Environment", UCLA Thought Leadership Forum, Los Angeles, California, USA, October 15, 2013.

### Keynote

- "Looking into the Future Protection, Automation and Control Systems", Keynote Address, 19th National Power Systems Conference (NPSC), IIT Bhubaneswar, Bhubaneswar, India, Dec. 21, 2016.

### Webinar

- "Centralized Protection and Control (CPC) within a Substation", IEEE Power & Energy Society, June 14, 2017.

### JOURNAL REVIEW

- Guest Editor, IEEE Transactions on Power Delivery Special section "Frontiers of Power System Protection", 2016
- Reviewer, IEEE Transactions on Power Delivery and IEEE Transactions on Smart Grid – since 1999 and 2013
- Reviewer, Energy Strategy Reviews, Elsevier – since 2016

### PATENT

1. Method and System for Through Fault Detection in Electrical Devices, With Sethuraman Ganesan and John M. Peterson, U.S. Patent No. 8,451,574 B2, May 28, 2013
2. Dynamic Energy Threshold Calculation for High Impedance Fault Detection, with John M. Peterson and Mohamed Y. Haj-Maharsi, U.S. Patent No. 7,085,659 B2; August 1, 2006
3. Fault Locator for Radial Sub-Transmission and Distribution Systems, with Joe Benco, U.S. Patent No. 6,591,203 B1; July 8, 2003
4. Current Based Frequency Tracking and Apparatus, with Joe Benco and Cliff Downs, U.S. Patent No. 6,298,309 B1; October 2, 2001

### PUBLICATIONS (Selected)

#### Journal

1. M. Bollen, **R. Das**, S. Djokic, P. Ciufo, J. Meyer, S. Rönnerberg and F. Zavoda, "Power Quality Concerns in Implementing Smart Distribution-Grid Applications", in Proc. IEEE Trans. Smart Grid, doi:10.1109/TSG.2016.2596788, Vol. 8, Issue 1, pp. 391-399, January **2017**.
2. Working Group on Centralized Substation Protection and Control, IEEE Power System Relaying Committee, "Advancements in Centralized Protection and Control within a Substation", in Proc. IEEE Trans. Power Delivery, doi:10.1109/TPWRD.2016.2528958, Vol. 31, No. 4, pp. 1945-1952, August **2016**.
3. **R. Das**, V. Madani, F. Aminifar, J. McDonald, S. S. Venkata, D. Novosel, A. Bose and M. Shahidehpour, "Distribution Automation Strategies: Evolution of Technologies and the Business Case", in Proc. IEEE Trans. Smart Grid, doi:10.1109/TSG.2014.2368393, pp. 2166-2175, July **2015**.
4. V. Madani, **R. Das**, F. Aminifar, J. McDonald, S. S. Venkata, D. Novosel, A. Bose and M. Shahidehpour, "Distribution Automation Strategies Challenges and Opportunities in a Changing Landscape", in Proc. IEEE Trans. Smart Grid, doi:10.1109/TSG.2014.2368382, pp. 2157-2165, July **2015**.
5. J6 Working Group of the Rotating Machinery Protection Subcommittee, IEEE Power System Relaying Committee, "Performance of Generator Protection During Major System Disturbances", in Proc. IEEE Trans. Power Delivery, Vol. 19, No. 4, pp. 1650-1662, October **2004**.
6. M.S. Sachdev, **R. Das** and T.S. Sidhu, "Distribution-line Shunt-fault Locations from Digital Relay Measurements", Canadian Journal of Electrical and Computer Engineering, Vol. 24, No. 1, pp. 41-47, January **1999**.

### Conference

7. V. Madani, **R. Das** and A.P. (Sakis) Meliopoulos, "Active Distribution Network and Microgrid Integration Strategy", In Proc. 7<sup>th</sup> International Conference on Power Systems (ICPS 2017), Pune, India, Dec. 21-23, **2017**.
8. **R. Das**, V. Madani and A.P. (Sakis) Meliopoulos, "DER Integration Using Microgrid for Resiliency and Application of Centralized Protection and Control", in Proc. PAC World Americas Conference, Raleigh, NC, USA, Aug. 29-31, **2017**.
9. **R. Das**, V. Madani and A.P. (Sakis) Meliopoulos, "Leveraging Smart Grid Technology and Using Microgrid as a Vehicle for DER Integration", in Proc. Eighth Conference on Innovative Smart Grid Technologies (ISGT), Washington DC, USA, Paper 0037, April 23-26, **2017**.
10. Working Group K15 on Centralized Substation Protection and Control, IEEE Power System Relaying Committee, "Looking into the Future Protection, Automation and Control Systems", In Proc. 2016 Georgia Tech Protective Relaying Conference, Atlanta, Georgia, USA, April 20 - 22, **2016**.
11. M. Bollen, S. Rönnerberg, S. Djokic, F. Zavoda, **R. Das**, Z. Zhong and M. Halpin, "CIGRE/CIREN WG C4.24 – Power Quality and EMC Issues associated with Future Electricity Networks – Status Report", in Proc. CIREN 23<sup>rd</sup> International Conference on Electricity Distribution, Lyon, France, June 15-18, **2015**.
12. H4 Working Group of the Relaying Communications Subcommittee, IEEE Power System Relaying Committee, "Summary Changes in 2013 IEEE/IEC Dual Logo COMTRADE Standard", in Proc. IEEE Power & Energy Society General Meeting, Paper No. GM2099, Vancouver, BC, Canada, July 21 - 25, **2013**.
13. **R. Das** and D. Bayoumi, "System for Detection of High Impedance Fault", in Proc. CIREN 19th International Conference on Electricity Distribution, Vienna, Austria, May 21-24, **2007**.
14. **R. Das**, "High Impedance Fault Detection System", in Proc. VIII Simposio Iberoamericano Sobre Protección De Sistemas Eléctricos De Potencia, Monterrey, Nuevo León, México, May 21-26, **2006**.
15. M. Carpenter, R. Hoad, R. Bruton, **R. Das**, S. Kunsman and J. Peterson, "Staged-Fault Testing for High Impedance Fault Data Collection", Proceedings of the 31st Annual Western Protective Relay Conference, pp. 1-18, Spokane, Washington, October 19-21, **2004**.
16. **R. Das**, "Real-time Simulation for Relay Performance Evaluation", Panel Session, IEEE 2004 Power Systems Conference & Exposition, New York City, NY, October 10-13, **2004**.
17. **R. Das**, M.M. Saha, P. Verho and D. Novosel, "Fault Location Techniques for Distribution Systems", in Proc. CIREN 17th International Conference on Electricity Distribution, Barcelona, Spain, May 15-17, **2003**.
18. **R. Das**, M.S. Sachdev and T.S. Sidhu, "A Fault Locator for Radial Subtransmission and Distribution Lines", in Proc. IEEE Power Engineering Society Summer Meeting, Paper No. 0-7803-6423-6/00, Seattle, Washington, USA, July 16 - 20, **2000**.
19. **R. Das** and D. Novosel, "Review of Fault Location Techniques for Transmission and Subtransmission Lines", in Proc. Georgia Tech Fault & Disturbance Analysis conference, pp. 1-16, Atlanta, May 1-2, **2000**.
20. M.S. Sachdev, T.S. Sidhu and **R. Das**, "A Fault Location Technique for Radial Subtransmission Lines with Tapped Load", in Proc. CIGRÉ Study Committee 34 Colloquium and Meeting, Florence, Italy, Paper No. 203, pp. 1-8, October 11-15, **1999**.
21. M.S. Sachdev, **R. Das** and T.S. Sidhu, "Determining Location of Faults in Distribution Systems", Proceedings of the Sixth International Conference on Developments in Power System Protection, The University of Nottingham, Conference publication No. 434, © IEE, 1997, pp. 188-191, UK, March 25-27, **1997**.
22. **R. Das**, M.S. Sachdev and T.S. Sidhu, "A Technique for Estimating Locations of Shunt Faults on Distribution Lines", in Proc. IEEE WESCANEX, Winnipeg, Manitoba, Canada, Vol. 1, pp. 6-11, May 15-16, **1995**.

### Magazine

23. T.S. Sidhu, M.S. Sachdev and **R. Das**, "Modern Relays: Research and Teaching Using PCs", IEEE Computer Applications in Power, pp. 50-55, April **1997**.

### Handbook

24. **R. Das**, "A New Approach to High Impedance Fault Detection", Electrical System Protection and Control Handbook (Vol. 2) published by The Electricity Forum, Ajax, ON, Canada, ISBN-0-9735726-3-9, pp. 83-88, **2004**.

**Encyclopedia**

25. **R. Das**, Article on 'Overcurrent Protection' for the supplementary electronic volumes to accompany the 24-volume, 2000-article Encyclopedia of Electrical and Electronics Engineering, edited by Prof. John G. Webster, Published by John Wiley and Sons, Inc., **2002, updated 2017**.

**Tutorial**

26. IEEE Tutorial Course, "Advancements in Microprocessor Based Protection and Communication", Coordinator: M.S. Sachdev, Chapter 10: M.S. Sachdev and **R. Das**, 'Bibliography', IEEE Power Engineering Society, Catalog Number 97TP120-0, pp. 82-127, **1997**.

**Report**

27. "Application of Phasor Measurement Units for Monitoring Power System Dynamic Performance", CIGRÉ Brochure, Working Group C4.34, Report No. 702, September 2017. [Online]. Available: <https://e-cigre.org/publication/702-application-of-phasor-measurement-units-for-monitoring-power-system-dynamic-performance>
28. "Centralized Substation Protection and Control," IEEE Power System Relaying Committee WGK15 Report, **2015**. [Online]. Available: [http://www.pes-psrc.org/Reports/IEEE\\_PES\\_PSRC\\_WG%20K15\\_Report\\_CPC\\_Dec\\_2015.pdf](http://www.pes-psrc.org/Reports/IEEE_PES_PSRC_WG%20K15_Report_CPC_Dec_2015.pdf)
29. "Understanding Microprocessor-based Technology Applied to Relaying," IEEE Power System Relaying Committee WG I16 Report, **2009**. [Online]. Available: <http://www.pes-psrc.org/Reports/UNTAR-Ed2.pdf>
30. "High Impedance Faults", CIGRÉ Brochure, Working Group B5.94, Report No. 402, December **2009**.