Gopal R Gajjar

CONTACT INFORMATION

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RESEARCH INTERESTS

Power System Protection, Digital Substations, Power System Operation and control, Wide Area Measurements, Phasor Measurement Units, Electromagnetic Transient Simulations.

EDUCATION

Ph.D. Mining Wide Area Frequency Measurements in Power Systems, 2015, Indian Institute of Technology, Bombay

M.Tech. Power Systems and Power Electronics, 2001, Indian Institute of Technology, Bombay

B.Engg. Electrical Engineering, 1999, The Maharaja Sayajirao University of Baroda

Diploma. Electrical Engineering, 1995, The Maharaja Sayajirao University of Baroda

PRESENT POSITION

Senior Project Research Scientist at Power Anser Labs. IIT Bombay since 2015.

POSITIONS HELD AND RESEARCH WORK

- Joined ABB Ltd. Corporate R & D, India in 2001 as power system R & D engineer.
- Worked at various position with responsibilities in power system analysis, transient simulations and protection coordination.
- Engineered a 400 kV outdoor switch-yard to gain experience in practical aspects of substation engineering.
- Studied and provided solution for several power system transient occurrences involving Circuit Breaker Switching, Lightning, Earthing and Ferroresonance.
- Was involved in protection function development for numerical relays for High Voltage and Medium Voltage applications.
- Function development for transformer monitoring and diagnostics.
- Research in Wide Area Measurement Systems as full time Ph.D. student at IIT Bombay, 2009 - 2015.
- Research focus on power system oscillation mode identification in ambient condition and post event.
- Research in applications of WAMS systems for identification of distance relays vulnerable to false operation during load encroachment and power swings.
- Research in energy control center applications of WAMS for secure power system operation.

PROJECTS AND TECHNICAL WORK

- Application development for wide area measurement systems for two large transmission system utilities of India. Involvement range from technical proposal preparation and defining the scope, up to lead researcher and developer. Background of the project is available at Link-1 and Link-2
  Year 2013 onward.
- Algorithm development for single ended fault location for distance protection for a reputed Indian relay manufacturer.
  Year 2021
- Review of activities of National Smart Grid Mission (NSGM).
  Year 2021
- Investigation of a false operation of busbar differential protection for a 220 kV system of a utility in India.
  Year 2019
- Algorithm development for controlled switching of transmission lines.
  Year 2020
- Algorithm development for controlled switching of transformers for a multinational power and automation firm.
  Year 2017
- Developed WAMS analytics tailored for smart grid laboratory for engineering colleges.
  Year 2017
- Consulting Service for CEM (Macau Electricity Utility) Power Protection System Migration : To review the protection system of existing Macau power system identify potential risk and gap in existing protection system, and advice on keeping the existing protection system and the migration from conventional protection to modern protection system that should be adopted at present and considered in future design.
  Year 2016.
- Expert advice in transmission system expansion planning for World Bank.
  Year 2016.
- Expert advice in protection algorithm development for numerical relays to reputed Indian relay manufacturer.
  Year 2016.
- Involved in technical consulting work for distribution system planning as researcher at IITB.
  Year 2013 - 2014.
- Involved in technical consulting for studying a failure of Vacuum circuit breaker switching a capacitor bank.
  Year 2012 - 2013.
- One of the developer and maintainer of IPDC - a Free Phasor Data Concentrator, released under GPL.
  Year 2010 onward.
- Mentored five students for their post graduate project work while working with ABB.
  Years 2001 - 2009.

Technical Awareness

- Worked with and applied in research and consulting following standards:
  - IEC 60071, IEC 62271, IEC 61850, IEEE 518, IEEE C37.111, IEEE C37.118, C37.244, C37.242, IEEE color books.
- Attend IEEE conferences and being observer in preparation of IEEE guide for Phasor Data Concentrator C37.244.
- Active participation in technical activities of Power System Relaying Committee for IEEE-PES.
- Acting as reviewer for several IEEE conferences and IEEE transaction in Power Delivery, Power System, Smart Grids.

Awards & Professional Recognition

- Recognition for outstanding Performance in R & D for ABB Ltd India, 2005.
- Received award for best paper in power systems at 18th National Power System Conference, Dec. 2014, at Guwahati.
- Recognition for exceptional contributions to IEEE transaction in Power Delivery paper review in 2017.

Professional Activities

- Member of IEEE since 1997, Senior Member of IEEE since 2016.
- Member of Power and Energy Society (PES) since 2012.
- Chair of IEEE-PES Gujarat chapter in 2016 and 2017.
- Executive Council Member of IEEE Gujarat Section in since 2021.
- Technical committee member of ICSP-2017, NPSC-2020.

Important Publications

Gajjar, G.R.; Khaparde, S.A.; Nagaraju, P.; Soman, S.A.; , "Application of actor-critic learning algorithm for optimal bidding problem of a Genco," *Power Systems, IEEE Transactions on , vol.18, no.1, pp. 11- 18, Feb 2003* doi: 10.1109/TPWRS.2002.807041 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1178750&isnumber=26471

H. Goklani, G. Gajjar and S. A. Soman, "Instrument Transformer Calibration and Robust Estimation of Transmission Line Parameters Using PMU Measurements," *IEEE Transactions on Power Systems, vol. 36, no. 3, pp. 1761-1770, May 2021.* doi: 10.1109/TPWRS.2020.3036605. https://ieeexplore.ieee.org/abstract/document/9252920

Raj, Akhil, Gopal Gajjar, and Shreevardhan Arunchandra Soman. "Controlled islanding of transmission system using synchrophasor measurements." *IET Generation, Transmission & Distribution 13.10 (2019): 1942-1951.* doi: 10.1049/iet-gtd.2018.5570. https://ietresearch.onlinelibrary.wiley.com/doi/pdf/10.1049/iet-gtd.2018.5570

K. V. Khandeparkar, S. A. Soman and G. Gajjar, "Detection and Correction of Systematic Errors in Instrument Transformers Along With Line Parameter Estimation Using PMU Data," *IEEE Transactions on Power Systems, vol. 32, no. 4, pp. 3089-3098, July 2017.* doi: 10.1109/TPWRS.2016.2620990 http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7747515&isnumber=7951114

Goklani, Hemantkumar, Gopal Gajjar, and S. A. Soman. "Quantification of minimum unbalance required for accurate estimation of sequence parameters of transmission line using pmu data." *2019 IEEE Power & Energy Society General Meeting (PESGM). IEEE, 2019.*

Goklani, Hemantkumar, Gopal Gajjar, and S. A. Soman. "Phase segregated soft calibration of instrument transformers using synchronised phasor measurements." *2018 Power Systems Computation Conference (PSCC). IEEE, 2018.*

Gopal. Gajjar and S. Soman, "Auto Detection of Power System Events Using Wide Area Frequency Measurements," *18th National Power System Conference NPSC-2014, Guwahati, 18-20 Dec. 2014.*

Gopal. Gajjar and S. Soman, "Power System Oscillation Modes Identifications: Guidelines for Applying TLS-ESPRIT Method," *International Journal of Emerging Electric Power Systems, vol. 14, no. 1, Jan. 2013.* URL: http://www.degruyter.com/view/j/ijeeps.2013.14.issue-1/ijeeps-2013-0023/ijeeps-2013-0023.xml

G. R. Gajjar and S. A. Soman, "Simulation of power systems for WAMS applications," *2016 IEEE 6th International Conference on Power Systems (ICPS), New Delhi, 2016, pp. 1-6.*

Lavand, S. A., G. R. Gajjar, S. A. Soman, and R. Gajbhiye. "Mining Spatial Frequency Time Series Data for Event Detection in Power Systems." *13th International Conference on Development in Power System Protection 2016 (DPSP), 2016 page 6.*

Gopal R Gajjar and S. A. Soman. "Analysis of Sustained Oscillations in Power Systems Observed Through Wide Measurements." *The 9th IEEE PES Asia-Pacific Power and Energy Engineering Conference, Bangalore, 2017.*

Gopal R Gajjar, Prashant V Navalkar and S. A. Soman."Considerations on Measurement Locations for WAMS Based Linear State Estimation of Power Systems." *7th International Conference on Power Systems, Pune, 2017.*

G. R. Gajjar and S. Soman, "Power System Oscillation Modes Identifications: Guidelines for Applying TLS-ESPRIT Method," *17th National Power System Conference NPSC-2012, Varanasi, 12-14 Dec. 2012.*

Gajjar, G.; Soman, S.A., "Power system oscillation modes identifications from wide area frequency measurement system," *Power System Technology (POWERCON), 2012 IEEE International Conference on , vol., no., pp.1,6, Oct. 30 2012-Nov. 2 2012* doi: 10.1109/PowerCon.2012.6401400 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6401400&isnumber=6401249

G. Gajjar, A. Kulkarni, S. Soman, "Interaction of capacitor bank inrush current limiting reactor and medium voltage vacuum circuit breakers", *International Conference on Power System Transients, Vancouver, July 2013* URL: www.ipstconf.org/papers/Proc_IPST2013/13IPST080.pdf

Avinash Waghambare, Shrikant Yeole, Uday Mali and Gopal Gajjar, "Satisfying Short Time Loop Flow Requirements in Distribution System", *International Conference on Power Systems, Kathmandu, Nepal. Oct 2013.*

K. A. Salunkhe, Gopal Gajjar, S. A. Soman and A. M. Kulkarni, "Implementation and Applications of a Wide Area Frequency Measurement System synchronized using Network Time Protocol", *IEEE Power and Energy General Meeting, Washington DC, July 2014.*

Gajjar, G.; Soman, S.A.; , "A proposal for distributed architecture for synchronized phasor measurement unit," *Power and Energy Systems (ICPS), 2011 International Conference on , vol., no., pp.1-7, 22-24 Dec. 2011* doi: 10.1109/ICPES.2011.6156634 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6156634&isnumber=6156604

Navalkar, P.; Gajjar, G.; , "Modeling of Vacuum Circuit Breaker and its use for studying reactor switching," *International Switchgear Conference, SWICON-2011, Mumbai, Nov. 2011.*

Kondala Rao, B.; Gopal Gajjar; , "Development and application of vacuum circuit breaker model in electromagnetic transient simulation," *Power India Conference, 2006 IEEE , vol., no., pp.7 pp., 0-0 0* doi: 10.1109/POWERI.2006.1632503 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1632503&isnumber=34235

Kandakatla, M.; Rao, B.K.; Gajjar, G.; , "Circuit Breaker Transient Recovery Voltage in Presence of Source Side Shunt Capacitor Bank," *Power System Technology and IEEE Power India Conference, 2008. POWERCON 2008. Joint International Conference on , vol., no., pp.1-6, 12-15 Oct. 2008* doi: 10.1109/ICPST.2008.4745184 URL: http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4745184&isnumber=4745149

Gajjar, G.; Patel, G.R.; Khandkar, A.; , "Application of Surge Capacitors to Mitigate High Transient Recovery Voltage," *International Switchgear Conference, SWICON-2004, Mumbai, Nov. 2004.*

Arya, A.; Chauhan, K.; Verma, S.; Gajjar, G; , "Urban Distribution System Planning: A Case Study", *National Power System Conference NPSC-2002*, Kharagpur, Dec. 2002.