

# A Plug and Play Operational Approach for Implementation of an Autonomous-Micro-Grid System

**Abstract** – The electric power system is going through an unprecedented transformation and related challenges in the implementation of smart grids. The smart grid is based on the flexible electrical power system that coordinates different energy resources and loads with the aim of delivering sustainable, economical and reliable electrical supply to the loads in an efficient manner.

In this presentation, a *plug and play type autonomous-microgrid system* formation is proposed. Multiple distributed generating sources and loads interaction is considered pertaining to the stability of the micro-grid. The proposed method enables communication-less operation of each of the elements of the micro-grid system. It is also considered that the sources are of different power capacity as can be seen in a typical autonomous micro-grid system. *Spatial Repetitive Controller* (SRC) is proposed to control each of the distributed generating sources in a decentralized manner to stabilize the overall micro-grid system. The proposed system considers sudden change in load as well as other distributed generators conditions like a true *plug and play* operation. A novel *signature frequency* voltage injection method is proposed to identify the presence of special distributed generator and operation of backup distributed generators. The implemented control architecture also ensures stability of the micro-grid fundamental frequency even in the case of dynamic conditions unlike the traditional *droop-control* method. A detailed experimental study is carried out and the experimental results presented show the efficacy of the proposed system.



Biography:

**Sanjib Kumar Panda (S'86-M'91-SM'01-F'2021)** received B. Eng. Degree from the South Gujarat University, India, in 1983, M.Tech. degree from the Indian Institute of Technology, Banaras Hindu University, Varanasi, India, in 1987, and the Ph.D. degree from the University of Cambridge, U.K., in 1991, all in electrical engineering. He was the recipient of the Cambridge-Nehru Scholarship and M. T. Mayer Graduate Scholarship during his PhD study (1987-1991). Since 1992, he has been holding a faculty position in the Department of Electrical and Computer Engineering, National University of Singapore and currently serving as an Associate Professor and Director of the Power & Energy Research Area. Dr. Panda has published more than 450 peer-reviewed research papers, co-authored one book and contributed to several book chapters, holds six patents and co-founder of three start-up companies. His research interests include high-performance control of motor drives and power electronic converters, condition monitoring and predictive maintenance, building energy efficiency enhancement etc. He is serving as an Associate Editor of several IEEE Transactions e.g. Power Electronics, Industry Applications, Energy Conversion, Access and IEEE Journal of Emerging and Selected Topics in Power Electronics. He is the Chair of the IEEE PELS Technical Committee, TC-12: Energy Access and Off-grid Systems.