Stability Modelling and Analysis of Converter Driven Power System

Abstract: The number of power electronics converters connected to electrical networks has been growing exponentially as they are part of all new generation connected to the grid. While the rapid control and fast electronic switching available with this technology offer flexibility in network operation, the dynamic interactions between several of them threaten the operational stability of the transmission grid is a concern. It is required to develop a methodology for identifying the risks associated with the stability and control interaction before a new power electronic device (e.g. Windfarm, interconnector, STATCOM) is introduced to the network
The talk will focus on an analytical framework in impedance domain to quantify the interaction between the new plant and the rest of the network for setting additional grid connection study specifications which will include detail technical study to check and mitigate the risks associated with new power electronics interfaced generation. The framework developed is to support MMC technology, control delay, system strength and FRT capability of dynamic voltage support devices and windfarm through technical case study conducted at the research group of Bikash Pal at Imperial College London. Future research challenges and opportunities will be highlighted.

Speaker: Bikash Pal is a Professor of Power Systems at Imperial College London (ICL). He is research active in power system stability, control, and estimation. Recently he led two six university UK-China research consortium on Resilient Operation of Sustainable Energy Systems (ROSES) as part of EPSRC-NSFC Programme on Sustainable Energy Supply (2020-2023) and on Power network stability with grid scale storage (2014-2017): He also led an eight- university UK-India research consortium project (2013-2017) on smart grid stability and control. His research is conducted in strategic partnership with ABB, GE Grid Solutions, UK, and National Grid, UK. UK Power Networks. GE commissioned sequel of projects with him to analyse and solve wind farm HVDC grid interaction problems (2013-2019). Prof Pal was the chief technical consultant for a panel of experts appointed by the UNFCCC CDM of the United Nations (UN). He has offered trainings to power engineers in Chile, Qatar, UAE, Malaysia and India in power system protections, stability and control topics. He has developed and validated a prize winning 68-bus power system model, which now forms a part of IEEE Benchmark Systems as a standard for researchers to validate their innovations in stability analysis and control design. He was the Editor-in-Chief of IEEE Transactions on Sustainable Energy (2012-2017) and Editor-in-Chief of IET Generation, Transmission and Distribution (2005-2012). He was Vice President, PES Publications (2019-23). In 2016, his research team won the President's outstanding research team award at Imperial College London (ICL). He is Fellow of IEEE for his contribution to power system stability and control and Fellow of The Royal Academy of Engineering, UK. He is an IEEE Distinguished Lecturer in Power distribution system estimation and control. He won the 2025 IEEE PES Prabha Kundur Award for his contribution to Robust Control and Estimation of Power Systems. He has published about 135 papers in IEEE Transactions and authored four books in power system modelling, dynamics, estimations and control. Two of his papers in power system stability and control topics have received annual best journal paper award. He was Otto Monsted Professor at Denmark Technical University (DTU) (2019) and Mercator Professor sponsored by German Research Foundation (DFG) at University of Duisburg-Essen in 2011. He worked as faculty at IIT Kanpur, India. He holds a

distinguished Visiting Professorship at the North China Electric Power University and Tsinghua University, China.