38. Design of adaptive power system stabiliser: B Pal

This project aims to investigate into adaptive controller design for synchronous generator oscillations which is highly non-linear. The method of Invariance and Immersion principle of control design is aimed to be applied. The performance robustness of the proposed control scheme has to be verified against various operating conditions of the system. Knowledge of synchronous generator modelling is an essential prerequisite for this project.

40. The control of parallel connected power converters: G. Weiss and B. Pal

Consider that a small island has to be supplied with electricity at close to nominal parameters (230V and 50Hz). Electricity is supplied by several arrays of solar panels (it is a tropical island) and, during the night, by batteries or fuel cells that have been charged during the day. Thus, all the available power is in DC form, and in different locations. There are several electronic DC to AC converters on the island, one near each array of solar panels (a few miles apart), and we have to connect them all to the local electricity grid. Clearly the converters must be synchronized and moreover, we must insure a "fair" sharing of the load. Moreover, the grid has to keep working even if some of the generating units fail (or are disconnected). Can this be done? It is desirable to achieve this without laying down communication cables between the generating units: thus, each unit sees only the grid voltage (and the locally produced DC voltage).

The problem may seem exotic but it is not: it would have applications on much larger and non-tropical islands. For synchronous generators (the classical scenario) this is a well understood problem which arises on every grid. For switched mode power converters, it is currently researched.

42. **Modelling 'Sen Transformers' in power flow studies: B. Pal**

This new class of transformer that emulates functionality of phase shifting, line reactance control and voltage regulation without involving any electronics are new. They need modelling to incorporate them in power flow studies. The project involves P-Q injection based and/or off-nominal trans-ration type transformer modelling. This also requires thorough knowledge of power system modelling. The course background on Electric energy system (E.313) and Environmental and economic issues in power systems (E4.39) and E4.38/C3.3 or similar courses taken by the M.Sc students in their B.Eng programme are must.

43. Modelling 'Sen Transformers' in stability studies: B. Pal

The project involves modelling mechanically switched discrete tap Sen Transformer for dynamic studies. This will lead to hybrid system (continuous and discrete). This is rather challenging from the perspective of dynamic voltage control of system. The work would start from normal tap-changer dynamics modelling and then include this new type of transformer that provides a large varities of functions such as voltage regulation, phase angle control, line reactance control and hence real and reactive power flow control in the line. The background knowledge covered in E3.13, E4.38 and E4.39 are must. The M.Sc students with similar course background in their B.Eng is also capable to do this project.