

Description of research activities

The research activities of the Institute can be grouped into two main areas:

1. Interaction between Power Electronic Systems and Power Grid

Due to the success of Power Electronics – enabled by the availability of powerful and efficient semiconductors and expedited by the extensive installation of renewable energies sources such as photovoltaics and wind power – electrical energy has to undergo a multitude of transformations by means of power electronic systems during the way from generation to consumer. Therefore, the characteristic of the grid and the power quality (stability of voltage level and frequency, harmonic content) will be essentially influenced by Power Electronic systems and components. Therefore, emphasis has to be given to the following aspects:

- Active power filter and selective harmonic cancellation
- Optimizing of (passive) filter for active infeed converter
- Handling of unsymmetrical load (occurrence of zero and negative sequence)
- Avoidance of unintended interaction between power electronic systems through the grid
- Island operation and black-start capability



Teststand for an inverter with active neutral for unbalanced power infeed

2. Energy efficient drives

The efficiency of a drive system is determined by the electric machine and the control methods implemented in the frequency converter. Requirements for efficiency of drives are described in the European standard EN 50598 "Ecodesign of Drives".



2L-VSC SiC inverter with low common mode voltage

Nowadays, predominately synchronous or induction machine are being used for drives. Alternatively, reluctance machines are under consideration in order to achieve a better tradeoff between efficiency and costs. However, control of reluctance machines including precise control of torque and position over the whole speed range is hard to implement, especially if there is no room for the application of position sensors for cost and reliability reasons.

Our research is focused on the precise torque and position control of reluctance machine taking into consideration the characteristics of the machine and the frequency converter.

Lab Facilities

The lab AC power is supplied by 5 transformers including voltage levels of 230V, 400V and 525V with a total power of more than 1MVA. Additionally a DC grid with up to 1.5kV and 192kW is available.



Institute staff in the lab facilities