

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY (LUT)

LUT ENERGY Department of Electrical Engineering – Research Unit of Power Electronics for Energy Efficiency and Sustainability (PEES)

Finland has a strong, globally operating power electronics industry, and PEES at Lappeenranta University of Technology plays a significant role in the development of Finland's power electronics industry.

PEES has around 70 employees (5 professors, c. 15 postdoctoral researchers, and around 50 post-graduate students). The PEES research teams work in tight collaboration in various application areas of energy efficiency, energy conversion and conditioning of energy. The PEES core competencies are in electrical drives technology and in electricity power delivery systems and regulation markets.



General view

In the field of electrical drives technology (Prof. Juha Pyrhönen), the research achievements of high international level are related to permanent magnet technology, control methods and power electronics applications (linear drives, mobile drives, solid-rotor high-speed drives,

AC drive technology, wind generators, model-based control of active magnet bearings, modulator control of power electronic devices, power line communication, medium-voltage converters, smart drives, fuel cells). The research achievements associated with electricity markets and power systems (Prof. Jarmo Partanen) include research activities related to low-voltage smart grids including for example new distribution arrangements based on DC systems or 1000 V AC systems, control of loads instead of production control, active energy storages, utilization of passenger electric cars in balancing the production and consumption in the grid and different distributed generation connected to the grid.

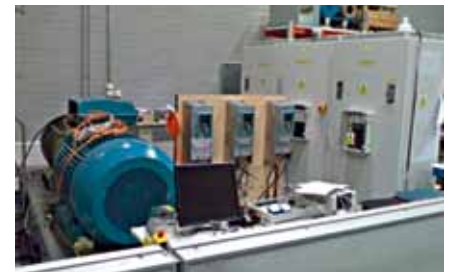
Power Electronics for Energy Efficient Energy Conversion Systems, Electric Energy Storages and Sustainability (PEECS)

PEECS is a PEES owned research program focusing on the most significant applications of power electronics technologies in industrial drives, distributed electricity generation, smart grids, transportation,



Drives test bench

and to some degree, domestic applications. PEECS contributes to energy efficiency enhancement and cost reductions by accurately controlling the electric power flow and storage applying intelligent power electronic control and by replacing mechanical or hydraulic systems



Medium voltage H-bridge inverter (3 kV) test setup

with electrical drives utilizing digital control algorithms. Our PEECS research infrastructure is inevitably the strongest in Finland in its own field. Research strength is assessed based on the number and productivity of the main researchers, scientific output, number of graduated doctors and international publications, especially, the quality of the power electronics and drives laboratory – Motorium Careliae (Figure 1), which on a European and even global scale has excellent research facilities with an infrastructure characterized by 300 m² of floor space (+ other laboratories), 1 MW power loss maximum, several test benches for motor drives up to 1 MW. The maximum speed available at 1 MW power is 12000 min⁻¹.