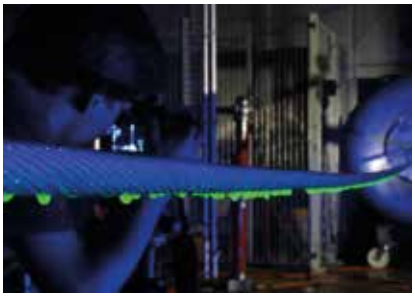


Power transmission technology

High voltage water drops

The researchers at the High Voltage Laboratory, led by Prof. Christian Franck, are investigating the environmental effects of a novel type of power transmission technology: hybrid AC/DC transmission. The main idea is to convert existing AC transmission corridors (the prevailing type of power transmission technology in Europe today) to systems in which AC and DC lines are used on the same tower. This has the potential to significantly increase the power throughput of an existing corridor and may delay or prevent the need to construct new overhead lines. The concept will be implemented in Germany in the coming years in a project called "Ultranet" – the first of its kind worldwide. The research team is supporting this project by investigating fundamental effects in the areas of electromagnetic fields and noise emissions. Water on the lines plays a crucial role with regard to these effects. The team is therefore analysing the distribution and shape of water drops by adding a UV-sensitive substance to the water.

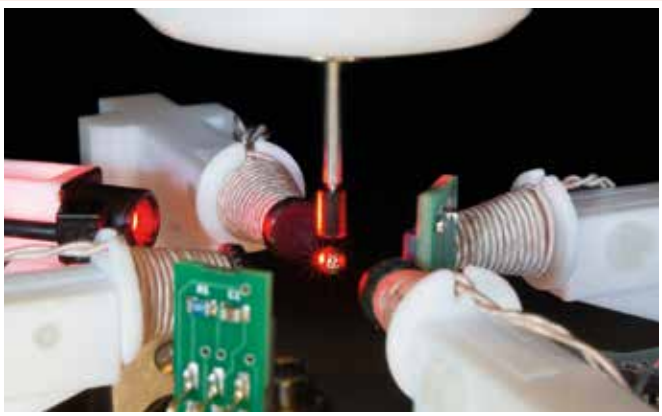
www.hvl.ee.ethz.ch

Electric power systems

Driven to optimise the grid

The existing power grids and their controls are designed for traditional power supplies, making them too inflexible as they essentially involve power flowing from central power plants to the consumer. The electrical power grids of the future will be much more distributed, with renewable generation and storage resources spread throughout the system and consumers becoming active grid participants. Coordinating all these elements in real time requires sophisticated control systems capable of balancing supply and demand in the grid. A research focus of the Power Systems Laboratory, led by Professor Gabriela Hug and working in collaboration with other groups at ETH Zurich, is on developing a modelling platform that simulates interactions among distributed resources, but also involving the bulk power grid. The platform also makes it possible to study the impacts of market design and policy decisions on grid operations. The laboratory derives methods that enable intelligent local and coordinated decision-making concerning the distributed resources, and optimal planning for future power grids.

www.psl.ee.ethz.ch



World record

No (speed) limit

The Power Electronic Systems Laboratory, led by Prof. Johann W. Kolar, researches magnetic bearings that enable effects such as the contactless levitation of rotors in electric machines without friction. Bearings offer benefits to the biopharmaceutical and semiconductor industries, and are well-suited to high rotational speeds. Exploring new territories in magnetic bearings research, the laboratory has developed an electric motor reaching rotational speeds of more than 40,000,000 revolutions per minute (through the doctoral research project of Marcel Schuck) – the world record for the highest rotational speed ever achieved by a machine of this kind and more than 100 times faster than a dental drill. To achieve such high speeds, a very small steel sphere with a diameter of less than 1 mm is used as a rotor. At full speed, a point on the equator of the sphere reaches more than 3,000 km/h. The system that has been developed can be used in materials testing applications, and the underlying research is paving the way for ultra-compact and highly efficient electrical drives – an essential element in a sustainable energy future.

www.pes.ee.ethz.ch