



The Joint IAS/PELS/IES German Chapter meets at EPFL, Lausanne, and CERN, Geneva, Switzerland, on June 2-3, 2005

The international chapter meeting took place in conjunction with a workshop and a seminar program at Ecole Polytechnique Fédérale de Lausanne, i. e. Swiss French speaking technical university. Many international guests attended the workshop and technical seminar on June 2nd, 2005, with lectures about the IEEE Future Energy Challenge 2005, the PSIM simulation environment, hybrid fuel cells for transportation and stationary power generation, and the opportunities and market needs for power electronics and power systems.

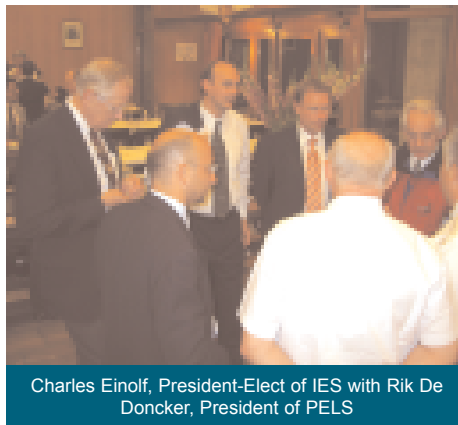
The social meeting took place at the restaurant de Dorigny of EPFL with a view on the beautiful scenery of lake Lemman up to Mont Blanc massif. Local organizer Prof. Rufer of EPFL opened the banquet. Interesting discussions about technical and other issues developed. Society presidents of IAS (Landis Floyd), PELS (Rik De Doncker), IES (Charles Einolf) and also past IAS 2000 president (Caio A. Ferreira) were present at the banquet. The organizers' gratitude for support of the meeting was expressed during an awards ceremony.

On June 3rd, 2005, more than 60 participants listened to the different lectures at EPFL. First Prof. Paul Sunderland gave an overview about the school of engineering of the EPFL. The school of engineering has an annual budget of about 90 million US\$. Research topics besides are reflected in different trans-disciplinary centers, namely space, brain&mind, Bernoulli, biological engineering and energy. EPFL in sum has 6400 students (2004) and 3120 employees. Faculty members come up to 50% from Switzerland, up to 25% from USA and up to 20% from all over Europe, where it has been ranked within the top 10 universities.

The second lecture given by Dr. Francois Marechal introduced the institute of energy sciences. Dr. Marechal explained the different research topics,

being related to each other, i. e. systems analysis, electromagnetic, fluid mechanics, heat and mass transfer and thermodynamics.

In the following Prof. Jean-Jacques Simond, head of the laboratory for electrical machines, presented insights about the modern design of high power generators. His special approach to solve the design of a 6-phase synchronous machine for a 20 MW gas compressor turbine is a machine with solid iron rotor with excitation and damper windings. Within the stator a double



Charles Einolf, President-Elect of IES with Rik De Doncker, President of PELS

winding scheme is used, where the first three phases are translated against the second three phases by an angle of 30° to eliminate the 5th and 7th harmonics of the flux linkage. With this translated double stator structure it is possible to suppress the 6th harmonic of the produced torque.

The next lecture given by General Chairman and host Prof. Alfred Rufer described an example of multi-disciplinary research in the field of a hybrid energy storage system. His approach uses compressed air and super-capacitors. Prof. Rufer explained the thermodynamics of pneumatic energy storage with some examples for the adiabatic, the isochoric and the isobaric state transitions needed to understand the hybrid energy storage system, and presented a novel UPS with compressed air and super-capacitors which uses a maximum efficiency point tracking control. The efficiency of the pneumatic

motor is less than 20%, leading to the suggestion to replace it by a hydraulic motor. This system and further setups for research and education

- such as a model railway or an electric scooter - have been demonstrated during a subsequent lab tour.

In the following Dr. Eric Carroll of ABB Switzerland gave an overview about high power semiconductor development and manufacturing. After a comparison of the safe operating areas (SOA) of IGBTs and IGCTs insights in the most advanced development of high SOA IGBTs with special switching self-clamping mode (SSCM) have been given. The presentation of the leading Swiss Power Semiconductor company concluded with an introduction to new diode developments, optimizing especially critical snap off behavior.

The digest of Swiss and European High Tech research and development was complemented by the presentation of Prof. Johann Kolar, ETH Zürich. After an introduction to ECPE, the European Center for Power Electronics - aiming at the promotion of research, innovation, education, publicity and technology transfer in the area of power electronics in Europe - he described particular research work carried out in cooperation with ECPE at his Power Electronic Systems Laboratory: This comprised topics like hybrid EMI filtering and matrix converters - especially sparse matrix converters including all-SiC versions to be operated at 150 kHz switching frequency. By successful integration, a power density of 25 kW/l has already been achieved, being a basis to work on the challenging number of 50 kW/l for the future.

An unforgettable highlight of the chapter meeting was the visit of European Research Center CERN in Geneva. Dr. Frederic Bordry of CERN power electronics group introduced the history of CERN, which has been founded in 1954; . . .continues on page 9



From the Emperor's coach to the O-Bus !

Dr. Ingo Hahn and Manuel Kennel report on the IEEE IAS/PELS/IES German Chapter Meeting at Wuppertal University

The first meeting of the IEEE IAS/PELS/IES German Chapter in 2005 was organized by the Electrical Machines and Drives Laboratory at Wuppertal University (Prof. Dr.-Ing. Ralph Kennel) and started in the afternoon of April 7th at the railway station of Solingen, which is located close to Wuppertal. From there the chapter members were transferred to the workshop of the "Solinger Stadtwerke" (public transport company of Solingen) by a special transport system - the O-Bus (trolley bus).

This bus uses dc voltage of 600 V and is one of only two trolley bus systems in Germany. The O-bus transports nearly 50% of all passengers within Solingen city - 60 000 daily. The chapter members had the opportunity to watch the modern drive technology of the O-Bus. Two engineers from the company

Kiepe Elektrik answered all questions concerning technical details of the used power electronics components within the trolley buses.

One of the newest trolley buses transported the visitors to the next highlight - the unique and world-famous Schwebbahn (suspension railway) of Wuppertal. This system is more than 100 years old - the trains are hanging "the wrong way around" under rails, which are built mostly above the river Wupper or over the streets of Wuppertal. The workshop of the Schwebbahn was visited. Within the workshop all replacement parts are produced, because the Schwebbahn is unique in the world.

Afterwards the visitors took a ride on the "Kaiserwagen" (emperor's coach),

a train used by the German emperor Wilhelm II and his wife 100 years ago. The "Schwebbahn" is supplied by an aluminium rail with a voltage of 600 V and operates on a track with 13.3 km length. Each train needs 30 minutes to cover the distance. The maximum speed is 60 km/h. After returning to the workshop of the "Schwebbahn" the members of the chapter had the opportunity to watch a movie about this special transport system, which carries around 70 000 people each day and is

machines and drives, presented some topics about the investigations done in the field of sensorless speed and position control of electrical machines, namely the asynchronous machine and the permanent magnet synchronous machine.

In the sequel Prof. Detlef Krahé, head of the institute of digital signal processing and electroacoustics, gave an overview about the research activities and the results in the field of active noise control and its' applications.

The last lecture was given by Dr. Wolfgang Fischer, chair for power electronics, Magdeburg University, about his investigations in using simulation tools.

The lectures were followed by the chapter awards ceremony: Prof. Werner Leonhard, Life Fellow, received the Chapter Award with

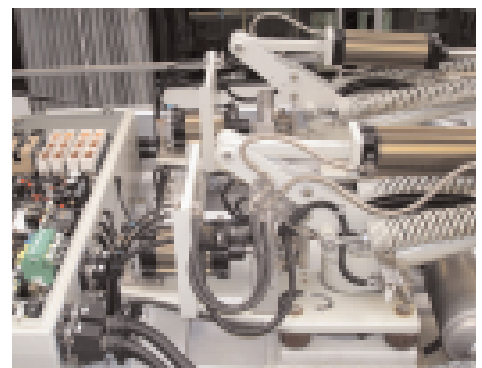
an induction motor trophy for his scientific contributions about "Nachhaltige Energieversorgung aus regenerative Quellen", i. e. sustainable energy supply using regenerative sources, and his continuous support of the chapter.



Old and new technology: on the left the "Kaiserwagen" (emperor's coach), a train used by the German emperor Wilhelm II and his wife 100 years ago; on the right the O-Bus (trolley bus), working with a dc voltage of 600 V, one of only two trolley bus systems in Germany

still the safest public transport system worldwide. The day closed with a nice dinner in the guest house of the Wuppertal University.

The second day the faculty of electrical engineering, information and media technology was presented by Prof. Bernd Tibken. One topic was the implementation of bachelors and masters degrees at german universities, while leaving the "Dipl.-Ing." degree in the future. Furthermore Prof. Bernd Tibken presented the institute of automatic control. Actual research activities are in the field of arithmetic interval theory, image processing in the loop, intelligent control systems and Lyapunov based control of dynamical systems. Next Prof. Joachim Holtz, emeritus of the institute of electrical



Detail of the O-Bus (trolley bus)