

**Opening of the Conference** 9.00 am - 9.15 am

**KEY-NOTE Paper (PC, IM and PQ participants)**  
9.15 am - 9.55 am

**Chairman: Ted Hopper, MACCON, GERMANY**

**K 1 POWER SYSTEMS AND EVOLUTION FACTORS - FROM THE STATE-OF-THE ART TO FUTURE TRENDS**  
M. Jufer, EPFL, SWITZERLAND

Power electronic systems and electric drives are often considered as out-of-date techniques, no more evolving. As most techniques, electrotechnics would disappear without evolution. Many factors influence this evolution and will be developed:

- the demand ; when the electric power system becomes the weakest point in a machine, it becomes automatically the key factor for the performances;
- the electronic components;
- the control systems and devices;
- the communication systems;
- the materials (ferrites, permanent magnets);
- the design optimization according to the applications
- the integration of the power system components and the integration into the global systems.

An example in the field of contactless energy transmission for electric vehicles will illustrate this presentation.

## Session IM 1

**INDUSTRIAL DRIVES, IMPROVEMENT IN MODULATION AND CONTROL** 10.00 am - 11.40 am

**Chairman: Gerhard Pfaff, University Erlangen-Nürnberg, GERMANY**

- IM 1.1 DTC PMSM DRIVES WITH TORQUE RIPPLE MINIMIZATION**  
P. Vas, M. Zordan, A.F.S. Stronach, M. Rashed, University of Aberdeen, UK
- IM 1.2 DESCRIPTION OF A NEW PWM-EXTENDED DTC STRATEGY FOR INDUCTION MOTOR DRIVES**  
E. Monmasson, A.A. Naassani, LESiR Cergy-Pontoise, J.P. Louis, LESiR Cachan, FRANCE
- IM 1.3 INVERTER FOR HIGH SPEED INDUCTION MOTOR DRIVE WITH LOW MAINS HARMONICS**  
P. Lürkens, Philips Research Laboratories, GERMANY
- IM 1.4 A PERFORMANCE COMPARISATION OF VARIOUS PWM SOLUTIONS USED FOR MOTOR CONTROL APPLICATIONS**  
G. Kupris, H. Kreidl, Motorola Microcontroller Division, GERMANY

## Dialogue Session

11.40 am - 12.40 pm

**Chairman: Silvio Colombi, IMV Invertomatik, SWITZERLAND**

- D 1 DEAD-TIME BEHAVIOUR IN PWM-VSI DRIVES WITH SPACE-VECTOR MODULATION TECHNIQUES**  
F. Herty, Universität Kaiserslautern, GERMANY
- D 2 TWO-PHASE PWM TECHNIQUES IN INVERTER FED AC DRIVES**  
S. Halász, A. Zaharov, Technical University of Budapest, HUNGARY
- D 3 TRADE-OFFS IN POWER FACTOR CONTROL OF DOUBLY FED RELUCTANCE MACHINES**  
M. G. Jovanovic, Liverpool John Moores University, UK

**D 4 A COMPUTER AIDED FORMULATION OF DYNAMIC AND STEADY-STATE ANALYSIS OF SINGLE-PHASE INDUCTION MOTOR WITH EXTERNAL ROTOR FOR DOMESTIC APPLICATIONS**  
M. Popescu, Helsinki University of Technology, FINLAND

**D 5 ENERGY SAVING MAINS-FED PM SYNCHRONOUS MOTOR WITH INTEGRATED SOLID STATE STARTER**  
A. Lelkes, J. Krotsch, ebm Werke, GERMANY

**D 6 PERFORMANCE ANALYSIS OF A SMALL ELECTRONICALLY-COMMUTATED DOUBLY-SALIENT PERMANENT-MAGNET MOTOR**  
M.M. Radulescu, C. Martis, Technical University of Cluj-Napoca, ROMANIA, I. Husain, University of Akron, USA

**D 7 ROBUST SERVOCONTROLLER FOR THE HYBRID STEPPER MOTOR DRIVE**  
C. Rusu, Technical University of Cluj, ROMANIA

**D 8 THREE - PHASE PWM VSI INDUCTION MOTOR DRIVES: VSI POWER TRANSMISSION OPTIMIZATION BY ADOPTING A SERIES - LINE TERMINATION NET**  
A. Fratta, G.M. Pellegrino, F. Scapino, F. Villata, Politecnico di Torino, ITALY

*Time for lunch and visiting the exhibition*

## Session IM 2

**MOTORS AND DRIVE SYSTEMS** 3.30 pm - 6.30 pm

**Chairman: Helmut Knöll, University of Applied Sciences Wuerzburg - Schweinfurt - Aschaffenburg, GERMANY**

**IM 2.1 KEY - NOTE Paper:**

**DRIVES 2000 END OF THE ROADMAP? - FROM THE STATE-OF-THE-ART TO FUTURE TRENDS**

J.M. Pacas, University of Siegen, GERMANY

The overwhelming developments of drive technology in the last two decades went through a road, defined by important milestones of the technical development: thyristor, transistor, integrated circuits, microprocessors and control theory. Now at the beginning of the new century drives are intelligent components with a high degree of development. The question for all manufacturers and for all researchers is: where are the potentials for a significant advancement in the technology. Departing from the present state of the art of industrial drives the paper presents the trends, which seem to build the future milestones of the development of drives in the next future.

**IM 2.2 FULL INTEGRATED SOLUTION FOR SERVOACTUATORS**  
A. Krug, Wittenstein Motion Control, GERMANY

**IM 2.3 MAGNETICALLY LEVITATED CENTRIFUGAL PUMP FOR HIGHLY PURE AND AGGRESSIVE CHEMICALS**  
M. Neff, ETH Zürich / Sulzer Electronics, SWITZERLAND

**IM 2.4 COMPARISON OF INDUCTION MACHINE MODELS - APPLICATION TO A NON-LINEAR FIELD ORIENTED CONTROL**  
J. Pierquin, C. Millet, C. Bergmann, I.U.T. de Nantes, FRANCE

**IM 2.5 CLOSED LOOP POSITION CONTROL OF A DOUBLE ARMATURE LINEAR DC MOTOR WITH SM-CO MAGNET**  
R.C. Okonkwo, R. Hanitsch, Technical University of Berlin, GERMANY

**IM 2.6 EXPERIMENTAL RESULTS OF A CURRENT SOURCE PWM-CONVERTER FED PERMANENT MAGNET SYNCHRONOUS MOTOR DRIVE**  
K. Kostı, S. Mika, T. Heikki, Tampere University of Technology, FINLAND

**IM 2.7 TANDEM INVERTER WITH SPACE-VECTOR MODULATION FOR VECTOR CONTROL OF INDUCTION MOTOR**  
M. Imecs, N. Patriciu, Technical University of Cluj-Napoca, ROMANIA, A.M. Trzynadlowski, University of Nevada, USA

## KEY-NOTE Paper (PC, IM and PQ participants)

8.30 am - 9.10 am

Chairman: Thierry Meynard, ENSEEIHT, FRANCE

### K 2 PROPERTIES AND APPLICATIONS OF SUPERCAPACITORS - FROM THE STATE-OF-THE-ART TO FUTURE TRENDS

A. Schneuwly, R. Gally, montena components SA, SWITZERLAND

Electrochemical double-layer capacitors, also known as supercapacitors or ultracapacitors, are electrical storage devices, which have a relatively high energy storage density simultaneously with a high power density. Recent developments in basic technology, materials and manufacturability have made supercapacitors an imperative tool for short-term energy storage in power electronics. With much higher energy density than today's capacitors and none of the problems associated with conventional battery technology, supercapacitors give an access to new power electronic and industrial storage applications.

The paper presents basic supercapacitor technology, component specific properties as well as state-of-the art products applications. The problematic nature of capacitors series connection for higher voltage applications is touched on. The review also deals with an energy storage system, which is based on the hybridization of rechargeable batteries and supercapacitors, with a suitable designed electronic interfacing arrangement in order to obtain a very high energy density device with a high power performance and a long lifetime. Finally, an overview over future trends regarding the supercapacitor technology as well as application scenarios, mainly in the tradition domaine, is given.

## Session IM 3

### SENSORLESS DRIVES, ARTIFICIAL INTELLIGENCE

9.15 am - 11.45 am

Chairman: Prof. Peter Vas, University of Aberdeen, UNITED KINGDOM

#### IM 3.1 KEY-NOTE Paper:

##### ADJUSTABLE SPEED DRIVES IN THE NEXT DECADE. FROM THE STATE-OF-THE-ART TO FUTURE TRENDS

P. Thogersen, Danfoss Drives, F. Blaabjerg, Aalborg University, DENMARK

The main trends for the next decade within the multi-disciplinarian field of Adjustable Speed Drives are discussed and a number of topics are specifically addressed in this paper. The topics include Market development over the last decade, historical development in Power Converter volume and weight, future drive demands, Power Converter architecture, Interfacing to the Grid, Motor types and Control principles. Furthermore, some of the possibilities and trends related to decentral 'intelligence' and Internet-connection are discussed. Technology development and cooperation between Academia and Industry in the next decade are also treated and discussed.

#### IM 3.2 SENSORLESS CONTROL ALGORITHMS FOR AC MOTORS - OVERVIEW AND DSP IMPLEMENTATION

M. Stähler, Texas Instruments, GERMANY

#### IM 3.3 FLUX-ANGLE IDENTIFICATION USING TEST SIGNALS FOR FIELD ORIENTED CONTROL OF INDUCTION MOTOR WITHOUT SPEED SENSOR AT VERY LOW STATOR FREQUENCY

M. Hövermann, B. Orlik, U. Schümann, University of Bremen, GERMANY

#### IM 3.4 SENSORLESS INFORM-BASED POSITIONING DRIVES

M. Schrödl, E. Robeischl, TU Vienna, T. Colle, High Tech Drives, AUSTRIA

#### IM 3.5 AN ARTIFICIAL NEURAL NETWORK POSITION ESTIMATOR FOR A DC MACHINE AND A SYNCHRONOUS MACHINE

M. Biremont, B. Feuvrie, C. Bergmann, I.U.T. de Nantes, FRANCE

#### IM 3.6 SENSORLESS SINUSOIDAL CONTROL OF BRUSHLESS MOTORS FOR REFRIGERATOR COMPRESSOR CONTROL

C. Vaidyanathan, P. Kettle, F. Moynihan, Analog Devices, USA

## Dialogue Session

11.45 am - 12.45 pm

Chairman: Manfred Schrödl, TU Vienna, AUSTRIA

#### D 9 A NEW FLEXIBLE ARCHITECTURE OF DIGITAL CONTROL SYSTEMS BASED ON DSP AND COMPLEX CPLD TECHNOLOGY FOR POWER CONVERSION APPLICATIONS

L. Debowski, M. T. Hartmann, The Electrotechnical Institute Gdansk, POLAND

#### D 10 TORQUE AND STATOR FLUX CONTROL OF PWM INVERTER-FED ASYNCHRONOUS MACHINE: A SLIDING MODE APPROACH

F. Moldoveanu, V. Comnac, M. Cernat, D. Floroian, Transilvania University of Brasov, ROMANIA

#### D 11 DESIGN AND SIMULATION OF $H_\infty$ CONTROL OF SWITCHED RELUCTANCE MOTOR

V. K. Sharma, Jamia Millia Islamia, H.C. Rai, IndraPrastha University, INDIA

#### D 12 ON-FLY PHASE RESISTANCE ESTIMATION OF SWITCHED RELUCTANCE MOTOR FOR SENSORLESS BASED CONTROL TECHNIQUES

L. Chalupa, R. Visinka, Motorola Czech Systems Laboratories, CZECH REPUBLIC

#### D 13 AN ADAPTIVE FUZZY CONTROL STRATEGY FOR A PRECISE POSITIONING SYSTEM

D. Mihai, University of Craiova, ROMANIA

#### D 14 UNIVERSAL DIGITAL MOTOR CONTROL PROCESSOR FOR HIGH PERFORMANCE INDUSTRIAL APPLICATIONS

L. Kreindler, Technosoft Switzerland, L. Antognini, Virtual Research, SWITZERLAND, R. Giuclea, A. Sarca, H. Minca, Polytechnic University of Bucharest, ROMANIA

#### D 15 THE INDEXBLOK™, A SENSORLESS SERVO POSITIONING DRIVE

K. Konecny, Semipower Systems, USA

#### D 16 SENSORLESS CONTROL OF THE INDUCTION MOTOR BASED ON NEW OBSERVER

Z. Krzeminski, Technical University of Gdansk, POLAND

#### D 17 THE APPLICATION OF NEURO-FUZZY CONTROLLERS AND ESTIMATORS IN DC AND DTC DRIVES

M. Neuroth, A.F. Stronach, P. Vas, University of Aberdeen, UK

#### D 18 FUZZY LOGIC CONTROL FOR AN INDUCTION MOTOR SUPPLIED BY A PWM VOLTAGE SOURCE INVERTER / CURRENT SOURCE INVERTER

P. Daniel, University of Craiova, T. Viorel, Technical University of Cluj, ROMANIA, I. Sergiu, S. Paul, Catholic University of Louvain, BELGIUM

#### D 19 PARAMETER IDENTIFICATION FOR A DC MACHINE USING A SIMPLE SPEED SENSOR

S. Hart, A. Ranjbar N., B. Mulhall, University of Surrey, UK

#### D 20 MECHANICAL SENSORLESS SPEED CONTROL OF INTERIOR PERMANENT MAGNET SYNCHRONOUS MACHINE BASED ON EXTENDED KALMAN FILTER

V. Comnac, M. Cernat, F. Moldoveanu, I. Draghici, R.-M. Cernat, Transilvania University of Brasov, ROMANIA

- D 21 DESIGN OF A WINDOWS-BASED DEVELOPMENT ENVIRONMENT FOR ADVANCED DIGITAL MOTION CONTROL**  
E. Chen, K.-Y. Cheng, S.-Y. Lin, Y.-Y. Tzou, National Chiao Tung University, TAIWAN
- D 22 DISTRIBUTED INTELLIGENCE ALLOWS NEW DIMENSION IN MANUFACTURING PROCESSES CONTROL**  
D. Jouve, D. Bui, INFRANOR, FRANCE

*Time for lunch and visiting the exhibition*

## Session IM 4

**MOTION AND AUTOMATION**      **3.30 pm - 6.00 pm**

**Chairman: Ted Hopper, MACCON, GERMANY**

- IM 4.1 INNOVATIVE DRIVE-CONTROLLER WITH FIELD ORIENTATED CURRENT-CONTROL AND OPTIMIZED SPACE-VECTOR-MODULATION, ENCODER-EVALUATION WITH OVERSAMPLING AND FERRARIS-ACCELERATION SENSOR.**  
F. Götz, J. Jiang, B. Liu, Baumüller, GERMANY
- IM 4.2 SYNCHRONIZED MOTION USING FIELDBUS LINKED ELECTRICAL DRIVES - AN ARCHITECTURAL ANALYSIS**  
H. Niemann, University Erlangen-Nürnberg, GERMANY
- IM 4.3 CANOPEN IMPLEMENTATION GUIDELINES AND APPLICATION HINTS**  
T. Schumann, CAN in Automation, GERMANY
- IM 4.4 THE ALPHA STEP SYSTEM, A SPECIAL CLOSED LOOP POSITIONING SYSTEM USING A TWO PHASE HYBRID STEP MOTOR**  
A. Houda, Oriental Motor, JAPAN, D. Jones, Increation Associates, USA
- IM 4.5 TUNING IN ZONES: AN EMPIRICAL METHOD FOR COMMISSIONING DRIVES**  
G. Ellis, Kollmorgen, USA
- IM 4.6 SAMCOP® MIX-AND-MARCH DRIVES**  
H. Langer, SCT, GERMANY

**GET - TOGETHER - PARTY**  
for all conference participants and exhibitors,  
**Exhibition Hall 12**  
**6.00 pm - approx. 8.30 pm**

## KEY-NOTE Paper (PC, IM and PQ participants) 8.30 am - 9.10 am

Chairman: Franz Zach, Technical University Vienna, AUSTRIA

- K 3 FACTS IN THE LIBERALIZED MARKET - FROM THE STATE-OF-THE-ART TO FUTURE TRENDS**  
G. Brauner, Vienna University of Technology, AUSTRIA
- Liberalization in the electricity supply utilities has led to a bunding into transmission, distribution, generation and energy trade. The transmission and distribution networks are forced to gain their money by transit tariffs.
- Due to the need for economic efficiency in the future, there will be lower investments into the transmission and distribution networks. Together with generation scheduling mainly due to the market rules but not to technical needs, the available transmission capacity will decrease. For maintaining a sufficient margin of available transmission capacity will decrease.
- For maintaining a sufficient margin of available transmission systems systems in future, there will be an increased use of FACTS in form of SVC (Statistic Voltage Group) and UPFC (Universal Power Flow Controller). Both are shown in their technical principles.
- For real transmission, their application will be shown and possible improvements in available transmission capacity and power quality is compared.

## Session IM 5

### VEHICLE AUXILIARIES / MACHINE DESIGN AND APPLICATIONS 9.15 am - 11.45 am

Chairman: Alfredo Vagati, Technical University Turin, ITALY

- IM 5.1 EQUALIZING COMBUSTION ENGINE TORQUE OUTPUT USING A STARTER GENERATOR**  
M. Beuschel, Technical University Munich, GERMANY
- IM 5.2 TRANSIENT BEHAVIOUR OF THE SLIPRING INDUCTION MACHINE WITH VOLTAGE SOURCE DC-LINK CONVERTER BY VOLTAGE BREAKDOWNS**  
H. Weiss, A. Schmidhofer, M. Lampersberger, University of Leoben, AUSTRIA
- IM 5.3 PM MOTOR DRIVES FOR FAN EQUIPMENTS**  
N. Bianchi, S. Bolognani, L. Malesani, University of Padova, ITALY
- IM 5.4 A NEW CIRCUITAL SOLUTION TO EFFICIENTLY DRIVE AN AC MONOPHASE MOTOR BY ST52 FUZZY MICROCONTROLLER**  
M. Di Guardo, M. Lo Presti, C. Vinci, STMicroelectronics, ITALY
- IM 5.5 MOTION CONTROLLERS CORRECT FOR NON-LINEARITIES OF PIEZO DRIVES**  
E.M.J. Smeets, Nyquist Industrial Control, NETHERLANDS

## Dialogue Session

11.45 am - 12.45 pm

Chairman: Salvatore Chiana, Consultant ABB, ITALY

- D 23 PERFORMANCE ANALYSIS OF A BRUSHLESS DC MOTOR FOR TRACTION APPLICATIONS**  
H. Zeroug, Institut of Electronics, ALGERIA, D. Grant, D. Holliday, N. Dahnoun, University of Bristol, UK
- D 24 MODELLING AND SIMULATION OF BRUSHLESS PERMANENT - MAGNET MOTOR DRIVES USING SABER**  
A. Szabo, M. Sparey, J. Coles, M. Holme; TRW Automotive, UK
- D 25 INDUCTION MOTORS DESIGNED FOR HEAVY DUTY**  
M. Teodorescu, N. Janicsko, A. Ghita, Electroputere, ROMANIA
- D 26 A NOVEL DESIGN PLATFORM FOR THE AUTOMATED DESIGN OF ELECTRICAL MACHINES**  
N. Bianchi, S. Bolognani, G. Strappazzon, University of Padova, O. Bottauscio, Istituto Elettrotecnico Nazionale „Galileo Ferraris“, A. Canova, M. Chiampi, M. Repetto, Polytechnic of Torino, ITALY
- D 27 METHODS FOR DETERMINATION BY EXPERIMENTAL WAY OF THE LOSSES AND EFFICIENCY AT ASYNCHRONOUS MACHINE SUPPLIED FROM CONVERTERS**  
O. Draganescu, University of Craiova, ROMANIA
- D 28 A NEW FAMILY OF DUAL H-BRIDGE MOTOR DRIVER ICs PROGRAMMABLE AND FULLY PROTECTED**  
A. Novelli, A. Genova, D. Arrigo, STMicroelectronics, ITALY
- D 29 MECHANICAL LOAD EMULATION TEST FACILITY TO ASSIST THE DEVELOPMENT OF ADEQUATE MACHINERY DIAGNOSTIC STRATEGIES**  
S.M.A. Cruz, A.J.M. Cardoso, J.P.F. Trovao, L.M.J. Pereira, R.T.C.T. Maia, Universidade de Coimbra, PORTUGAL
- D 30 PARAMETERS OF LINEAR VOICE COIL ACTUATORS OF DIFFERENT CONSTRUCTIONS**  
M. Godkin, BEI Kimco Magnetics, USA

*Time for lunch and visiting the exhibition*

## Session IM 6

### COMPONENTS, TEST FACILITIES

3.00 pm - 4.40 pm

Chairman: Dan Jones, Inccremotion, USA

- IM 6.1 EXTRACTION OF HIGH RESOLUTION POSITION INFORMATION FROM SINUSOIDAL ENCODERS**  
J. Burke, J.F. Moynihan, K. Unterkofler, Analog Devices, USA
- IM 6.2 HIGH-PERFORMANCE DRIVES EMPLOYING SMART SENSOR BEARINGS**  
P. Vas, M. Rashed, A.K.M. Joukhadar, M. Zordan, University of Aberdeen, UK, J. Duits, E.G.M. Holweg, SKF Engineering and Research Centre, NETHERLANDS
- IM 6.3 ROTOR ASYMMETRY MONITORING FOR SLIP-RING AND SQUIRREL CAGE INDUCTION MACHINES BY MEANS OF THE VIENNA MONITORING METHODE**  
C. Kral, F. Pirker, G. Pascoli, Vienna University of Technology, AUSTRIA
- IM 6.4 CONCEPT OF NOISE MINIMIZATION OF THREE-PHASE CURRENT MACHINES BY VARIATION AND MODIFICATION OF CONTROL SCHEME AND POWER ELECTRONICS**  
S. Soter, R. Lach, S. Kulig, University of Dortmund, GERMANY