TITLE

Recent Advancements in Digital Implementation of AC Drive Controllers

NAME AND AFFILIATION OF THE AUTHORS

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SCOPE AND BENEFITS

Digital components and their associated development tools are continuously gaining in performances and flexibility. Today's components are now offering exciting new possibilities to the designers like MultiProcessor System-on-Chip (MPSoC). Among the different available digital technologies, Field Programmable Gate Array (FPGA) is one of the most promising for controlling present and future power applications. In this tutorial an in-depth state-of-the-art presentation of FPGA-based controllers for AC drive applications will be given. All the main modules of AC drive controllers will be presented in details (Pulse width Modulator (PWM), current controller, speed controller, estimator for sensorless applications,…). For each module, the impact of a dedicated digital implementation on the performances of the drives will be thoroughly exposed. Thus, it will be shown how the rapidity and the flexibility of FPGAs help rising significantly the performances of the drives. An important focus will be also done on stringent industrial embedded applications (mainly aircraft). Finally, conclusions will be drawn and future trends given.

CONTENTS

Half day tutorial (3.5H), **Monday, September 2nd - Tutorial day (Location: University of Lille)**

08:00 - 09:00   Registration for **Tutorials**

09:00 - 11:00   Tutorials Part 1 (2H)

- Introduction
  - State-of-the-art of the digital controllers
  - Contribution of FPGAs for AC Drive Applications, why FPGAs?
    - Contributions in terms of Control Performances
    - Contributions in terms of System Integration
  - Design methodology

- FPGA-based Current control and PWM strategies
  - PWM strategies
  - Linear current control

- Non-linear current control
- Predictive current control

11:00 - 11:30   Coffee break

11.30 - 13:00   Tutorials Part 2 (1.5H)

- FPGA-based sensorless control
  - High frequency signal injection
  - Extended Kalman filter
  - Aircraft industrial examples

- New trends on algorithms and architectures
  - System-on-Chip (SoC) and Multiple-System-on-Chip (MSoC) (r)evolution
  - RT simulation
  - On-line parameter identification

- Conclusions and Perspectives

WHO SHOULD ATTEND

The expected audience is mainly industry engineers, PhD students and professors. A background on AC drives and industrial informatics is expected but is not mandatory.

ABOUT THE INSTRUCTOR

Eric Monmasson (M'96-SM'06) received the Ing. and Ph.D. degrees from the Ecole Nationale Supérieure d'Ingénieurs d'Electrotechnique d'Electronique d'Informatique et d'Hydraulique de Toulouse (ENSEEIHT), Toulouse, France, in 1989 and 1993, respectively. Eric Monmasson is currently a full professor at the University of Cergy-Pontoise, Cergy-Pontoise, France. He is also with the Systèmes et Applications des Technologies de l'Information et de l'Energie laboratory (SATIE, UMR CNRS8029). His current research interests include the advanced control of electrical motors and generators and the use of FPGAs for energy control systems. He was the chair of the technical committee on Electronic Systems-on-Chip of the IEEE Industrial Electronics Society (2008-2011). He is also a member of the steering committee of the European Power Electronics Association and the chair of the number one technical committee of the International Association for Mathematics and Computers in Simulation (IMACS). He was the general chair of ELECTRIMACS 2011 Conference. He is an associate editor of IEEE Transactions on Industrial Electronics and IEEE Transactions on Industrial Informatics. He is the author or coauthor of 3 books and more than 150 scientific papers.