

## **TITLE: EU Project Motor Challenge – Recommendations and Comments**

### **NAME AND AFFILIATION OF THE AUTHORS**

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### **SCOPE AND BENEFITS**

In this tutorial you will inform about results of EU project Motor Challenge. It is well known that electric drives are the greatest consumers of electric energy, so as the best kWh is the saved one. In this you will learn how to save electric energy in electric drives, improving the production process with lower production costs and reducing global pollution with emission of green house gasses (GHG). You will understand that consumption of non-active energy (reactive and distortion) is not negligible. The tutorial is supported by practical examples with real measurements. Presented material is based on duty cycles of electric drives (IEC 60034-1), power measurement (DIN 40110) and power quality/harmonics (IEC 6100-3-2, IEC 61000-3-4).

### **CONTENTS**

Results of EU project “Motor Challenge” are presented. Energy efficiency is basis of technical systems working. Electric drives account for approximately 65% of the electricity consumed by EU industry. The efficiency of an electric drive depends on more factors, including: motor efficiency, motor speed control, proper sizing, power supply quality, distribution losses, mechanical transmission, maintenance practices, end-use mechanical efficiency (pump, compressor, fan, etc.). The energy efficiency has influence on the work of electric drive, its consumption and paying of electric energy (active, reactive), the working life etc. What energy efficiency practice for? The answer is simple - because of getting high quality and cheaper products, lower production costs and reducing of global pollution. How to realize energy efficiency in electric drives? The right way is with usage of better working machines, power convertors for getting variable speed to reduce power losses and energy efficient motors. These lectures deal strongly with energy efficiency in electric drives through energy parameters - efficiency  $\eta$  and power factor  $\lambda$  (in special case with ideal supply without harmonics  $\cos \varphi$ ). The attention is focused on motor speed control with saving potential of 50 billion kWh/year for EU-25 and motor losses expressed through its efficiency and power factor, with saving potential more than 27 billion kWh/year for EU-25, as it is recommended in results of MChP.

### **WHO SHOULD ATTEND**

This tutorial is convenient for large scale participants: students, engineers, researchers.

**Technical Level:** Technical level of the tutorial is advanced, interdisciplinary and multidisciplinary, because knowledge of electric drives, power electronics and global pollution is needed.



Slobodan Angel Mirchevski was born on February 16, 1950 in Skopje, Republic of Macedonia. He has received the B.Sc. degree in electrical engineering, M.Sc. degree and Ph.D. degree from University "Sts. Cyril and Methodius"-Skopje, in 1975, 1984 and 1990 respectively. From 1975 to 1979 he was with Mines and Steelworks "Skopje", where he worked in the fields of electrical machines and control of drives in rolling mills. From 1979 to the present he is with Faculty of Electrical Engineering and Information Technologies in Skopje. In more mandates he was a head of the Institute for power engineering. Twice his duties were positions of vice dean for education (1997-1999) and vice dean for finances (1999-2001). He was a member of the University Senate (2001-05) and member of inter universities conference (2005-09). As DAAD stipendium user he realized two specializations in Germany, University Erlangen-Nuremberg, Institute for electric drives and control, in 1984 and 1995. Now he is a full professor for electrical drives and a head of Laboratory for electric drives. Also he was a head of the three years (1994-1996) research project "Rational using of electric energy in AC drives", financed by Ministry of Science. He is an author of more than 150 scientific and professional papers and many application works (more than 50) in industry. He is an author of more invited papers. He has been a member of IEEE (IAS), CIGRE, IFAC for more years. From March 2002 he is a Senior Member of IEEE. He was a participant as a scientific investigator in TEMPUS PHARE JEP S 12103-97 "Development of Power Electronics Courses" and TEMPUS PHARE CME 03118-97 "System of Quality Assurance in Higher Education in Macedonia". As a participant in the TEMPUS PHARE JEP S 12103-97 "Development of Power Electronics Courses" he was on retraining at the Università degli Studi di Milano, Dipartimento di Fisica, Sezione Elettronica from 01.07.2000 to 25.07.2000. As a participant in DAAD Project (Mechatronics in high education in the countries of South-East Europe) he stayed in Ilmenau, Germany from 16.02.2002 to 10.03.2002. Under his leadership 104 diploma works, 7 M.Sc. works and 1 Ph.D. thesis are realized. His areas of interest are electric drives, their control and energy efficiency. He was observer member of SC A1 CIGRE and president of SC A1 of Mako CIGRE, 2006-14. He is founder and president of Macedonian Association for Power electronics, drives and control 2009-13. He was a member of Editorial Board of EPE Journal - Brussels and Editorial Board of International Journal of Renewable Energy Sources 2009-13. Also he is a member of PEMC Council, EPE Executive Council and EPE General Assembly. He had an opportunity to be the general chairman of the successful conference EPE-PEMC 2010, held in Ohrid, Republic of Macedonia, 6-8 September 2010. At EPE'13 ECCE in Lille he was a chairman of dialogue session about energy efficiency. He has 2 participations on JRC Workshops about smart grids in Antalya, in September 2013 and in April 2014. In November 2014 he was a visiting professor on "Advanced PhD EU Project" at Gdansk University of Technology with the course Energy Efficiency in Electric Drives. He was a lecturer of tutorial "Energy Efficiency in Electric Drives" at EPE ECCE'15 in Geneva.