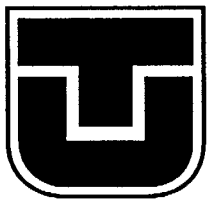
Technical University of Košice, Slovakia
Faculty of Electrical Engineering and Informatics



Annual Report

1997

Department of Electrical Drives

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Contents

Foreword

The report continues in the series of the Annual reports issued by the Department of Electrical Drives (Katedra elektrických pohonov) in order to present activities during the year 1997. It contains information about position and structure of the department, information about under- and postgraduate courses, overview of students' works, research activities and projects with industry, list of publications, information about the staff members and about scientific and other events organised by the Department in the year 1997.

The year 1997 was rich on events, of course. Several events marked the departmental life having reflections both in the professional career and in personal life:

- we continued with co-operation with the colleagues from the Czech Republic - in the beginning of the year we organised "KOPES" – a common workshop of teachers of electrical machines and apparatus,
- we further continued in co-operation with the Department of Electrical and Electronic Engineering of the University of Miskolc by mutual participation in organised scientific events,
- Ing. Vladislav Maxim successfully defended his dissertation,
- we continued in series of short specialised courses for specialists from industry ,
- we opened a new three-year BSc. undergraduate course with 17 students,
- there have been 6 specialised research teams at the department,
- in field of co-operation with industry there have been involved in 9 projects.

There also were some movements concerning the departmental staff :

- a group of 6 staff members left the Department and founded a Laboratory of Industrial Engineering (in April), as a result of solution of the TEMPUS JEP-09484-95 project
- several members left the Department: Ing. Stanislav Kovalčin, CSc., Ing. Vladimír Kolcun, Doc. Ing. Juraj Oetter, CSc. and Doc. Ing. Imrich Pokorný, CSc. (he retired but he still is partly employed by the department),
- we have also two new staff members: Ing Katarína Harčarufková and Ing. Iveta Kochová.

The description in this brochure is necessarily brief and further information can be obtained by contacting the department or the person concerned Further details can also be also in homepage on Internet (http://www2.tuke.sk/tu/fei/kep/kep-s.html).

Doc. Ing. Jozef Fedor, CSc.
Head of the Department

1. Introduction

The Faculty of Electrical Engineering and Informatics (FEI) of the Technical University of Košice was founded in 1969. Since its establishment 6031 students graduated at the faculty (in 1996 there were 231 brand new graduates). Currently there are about 1910 undergraduate and 126 postgraduate students. The faculty staff consists of 203 members, among them 13 full professors, 51 associate professors, 105 assistant professors, 11 assistants and 23 research workers.

The Faculty offers full university education in five-year undergaduate courses (MSc. degree, with the title Ing.). After finishing two years of study filled by basic general subjects and main subjects from electrical engineering, in subsequent years the students can choose their specialisation. At the end of the engineering courses, students defend graduate theses (diploma works). The FEI offers also other types of education: three-year BSc. (undergraduate) courses and three-year PhD. (postgraduate) courses.

The Department of Electrical Drives - Katedra elektrických pohonov (KEP) is one of the 11 units of the FEI (10 departments and 1 specialised laboratory). The Department is responsible for education in subjects concerning the electrical engineering. The main aim is to prepare undergraduate students for their career both in industry and research. The Department offers both types of undergaduate courses (MSc. and BSc.) as well as the PhD. postgraduate course.

Since the faculty establishment in 1969, totally 1431 students graduated at the Department.

The students are studying at the Department since the third year of their study: in the current 1997/98 academic year there are totally 98 students studying at the department (31 students in the third year, 30 in the fourth and 37 students in the fifth year).

The Department offers also postgraduate education. Since its establishment, 34 postgraduate students have defended successfully their dissertations and were awarded by the CSc. degree (equivalent of a PhD. degree). There are 11 supervisors within the Department specialised in different fields of electrical engineering. The current number of full- and part-time PhD. students is 10.

The Department is strong involved in teaching of the electrical engineering subjects for students studying at other faculties of the Technical University. The number of students from Faculty of Mechanical Engineering (SjF) reaches 299, Faculty of Mining Engineering (FBERG) - 235 and Faculty of Metallurgical Engineering (HF) - 150.

2. Structure of the Department

The current number of staff members is 35; among them 27 full academic staff members, 3 researchers and 5 supporting and technical staff. The department is divided into 3 divisions, according to the field of specialisation:

- Division of Electrical Drives.
- Division of Industrial Electronics and Automation.
- Division of Electrical Machines and Apparatus.

An overview over divisions of the department is given in the table:

Head of Department:	***Jozef Fedor***
Deputy Head of Department:	***Viliam Fedák***

Divisions:

Electrical Drives	**Industrial Electronics and Automation**	**Electrical Machines and Apparatus**
Jaroslav Tomko.	***Jaroslav Dudrík***	***Pavel Záskalický***
Jaroslav Timko	Irena Kováčová	Jozef Fedor
Ladislav Zboray	Jozef Ondera	Bartolomej Fedor
Viliam Fedák	Imrich Pokorný	Želmíra Ferková
Ján Fetyko	Peter Višnyi - research worker	Ján Kaňuch
František Ďurovský	Peter Dzurko - PhD. student	Iveta Kochová
Jaroslava Žilková	Pavol Fedor	Michal Kostelný
Vladislav Maxim	Stanislav Fedor	Juraj Németh
Dionýz Milly	Daniela Perduková	Miroslav Tvrdoň
Le Quang Duc - PhD. student	Rastislav Harčarufka	
Dušan Balara - PhD. student	Katarína Harčarufková – research worker	
Martin Frena - PhD. student		
Tibor Takáč - PhD. student		

Support and Technical Staff
Veronika Majerníková
Katarína Gočová
Vasiľ Graban
Alena Jakabová
Štefan Záhorjan

3. Education (courses offered in 1997/98)

3.1 MSc. (Undergraduate) Course (5 years)

The students are taught at the Department since the third year of study and are specialised according to their interest by choosing the optional subjects from the list. In such way they approach more-or-less to the specialisation:

1. Electrical Drives.
2. Power Electronics.
3. Electrical Machines and Apparatus.
4. Automation of Electrical Equipment.

1. Electrical Drives

Students are prepared for design and operation of electrical drives used to drive various working machines and mechanisms. During study period the students are also acquainted with knowledge of power and control electronics and computer techniques, control of single and multi-motor electromechanical systems (robots, manipulators and technological lines).

2. Power Electronics

Power Electronics is dealing with control and transformation of electrical energy from an available form into a required form. Besides the fundamental subjects the students are prepared for analysis, modelling, design, construction, and control of power semiconductor converters. They receive deeper knowledge from electronics, esp. digital electronics.

3. Electrical Machines and Apparatus

The students are taught theory, design, technology and construction of electrical machines and apparatus using classical and computer - aided design methods.

4. Automation of Electrical Equipment

The stress is focused on subjects concerning electronics and microelectronics, advanced control theory, computer technique, design of control and regulation for complex systems, both from the HW and SW points of view. The goal of the study is to prepare students to design and maintain the control systems of technological processes.

Overview of the MSc.(Undergraduate) Course Programme

The Third Year

Duration: 14 + 14 weeks

Option Subject	Semester:	5th Lect./Lab.	6th	N° of credits	Lecturer
Compulsory Subjects					
Social Sciences		0/2 ca		2	
Theory of Control		2/2 ex		5	Bučko
Applied Electronics		3/3 ex		7	Kováčová
Electrical Machines I.		3/3 ex		7	Kostelný

Optional Subjects (students choose min. 2 subjects)				
Superconductivity and Ferromagnetism	3/1 ex		4	Dudáš
Control Systems Software	2/2 ex		5	Timko, Harčarufka
Mechanics	2/2 ex		4	Jurica
Electrical Heating and Lighting	2/2 ex		4	Šefčíková
Electromechanical Systems	2/2 ex		5	Fedák, Fetyko
Applied Mathematics	2/2 ex		4	Pirč
Compulsory Subjects				
Power Electronics I.		3/3 ex	7	Dudrík
Automation of Electrical Equipment I.		2/3 ex	6	Girman, Bober
Electrical Apparatus		3/2 ex	6	Fedor J.
Optional Subjects (students choose min. 2 subjects)				
Components of Digital Control Systems		3/3 ex	7	Fedor P., Perduková
Electrical Machines II.		3/3 ex	7	Kostelný
Interfaces in Control Systems		2/2 ex	4	Girman, Bober
Modelling and Measur. of Control Circuits		1/3 ex	4	Kováčová
Optional Subject from the Faculty List				
Required number of credits			60	

The Fourth Year

Duration: 14 + 14 weeks

Option Subject	Semester:	7th Lect./Lab.	8th	N° of credits	Lecturer
Compulsory Subjects					
Electrical Drives		3/3 ex		7	Timko
Power Engineering I.		3/3 ex		7	Varga L., Ilenin
Optional Subjects (students choose min. 3 subjects)					
State Control of Electrical Drives		2/3 ex		6	Zboray
Control Systems Construction		2/3 ex		6	Girman, Bober
Industrial Systems Identification		2/3 ex		6	Fedák
Control Circuits for Power Electronics		2/3 ex		6	Dudrík, Višnyi
Computer Aided Design		2/3 ex		6	Fedák, Tvrdoň
Electrical Machines Construction		3/2 ex		6	Ferková
Modelling of Converters		1/3 ex		5	Kováčová
Parts and Systems of Mechanisms		2/2 ex		4	
Optional Subject from the Faculty List					
Compulsory Subjects					
Economy I.			0/2 ca	2	
Controlled Drives			3/3 ex	7	Zboray
Automation of Electrical Equipment II.			3/3 ex	7	Fedor P.

Optional Subjects (students choose min. 3 subjects)				
Electrical Apparatus Construction	2/3 ex		6	Fedor J.
Electrical Drives Design	2/3 ex		6	Tomko, Milly
Complex Drive Systems	2/3 ex		6	Fedák
Power Semiconductor Converters II.	2/3 ex		6	Ondera
Power Engineering II.	3/2 ex		6	Chladný, Tkáč
Computer Aided Design	0/2 ca		2	Fedor S.
Circuits of Controlling Electronics	0/2 ca		2	Fedor S.
Power Electronics Laboratory Practice	0/2 ca		2	
Required number of credits			60	

The Fifth Year

Duration: 14 + 10 weeks

Option Subject	Semester:	9th Lect./Lab.	10th	N° of credits	Lecturer
Compulsory Subjects					
Economy II.		0/2 ca		2	
Master Thesis Seminar		0/5 ca		5	
Optional Subjects (students choose min. 4 subjects)					
Special El. Machines and Apparatus		3/2 ex		6	Kostelný, Fedor J.
Semiconductor Converters Applications		2/3 ex		6	Ondera
Converters Design and Construction		2/3 ex		6	Pokorný, Maxim
Control of Robots and Manipulators		2/3 ex		6	Fetyko
Control Systems of Technological Lines		2/3 ex		6	Fedor P, Harčarufka
Industrial Drives		2/3 ex		6	Tomko
High-Voltage Technique		2/3 ex		5	Marton
Electrical Equipment Construction		2/2 ex		5	Dudrík, Fedor S.
Microcomputer Control of Converters		2/2 ex		5	Višnyi
Optional Subject from the Faculty List					
Master Thesis (Diploma Work)			x		
Required number of credits				30	

The Department of Electrical Drives ensures teaching of specialised subjects in other lines of study at the FEI and is also responsible for teaching of the following subjects in field of electrical engineering at other faculties of the Technical University: *Fundamentals of Electrical Engineering* (for different faculties), *Apparatus and Equipment, Electrical Apparatus for Working Machines, Special Electrical Drives, Electronic Elements, Drives and Power Electronics, Electrical Equipment for Machines in Food Industry, Instrument Engineering, Electrical Drives and Electrical Accessories of Machines in Food Industry, Electrical Drives and Electrical Accessories of Agricultural Machines, Special Electronics, Electrical Drives, Electrical Apparatus, Electrical Machines.*

3.2 BSc. (Undergraduate) Course (3 years)

The new BSc. Course Electrical Engineering was designed with the aim to educate the students to meet industrial requirements. In this course the students will:

- receive fundamental theoretical knowledge in mathematics, physics, electromechanics and also in electrical engineering, power electronics, electrical drives and computers,
- get practical skills with design of circuits and subsystems, mainly in power semiconductor converters, motors and controlling systems of the drives,
- obtain knowledge in economics and business.

During the study period there are two practices (called: engineering applications - EA):

- EA I. (4 weeks of work at the department) in the first academic year,
- EA II. (3 weeks at department + 3 weeks in industry) in the second year.

Overview of the BSc. (Undergraduate) Course Programme

First Year

Duration: 14 + 14 weeks + 4 weeks EA I.

Option Subject	Semester: 1st Lect./Lab.	2nd Lect./Lab.	N° of credits	Lecturer
Fundamentals of Electrical Engineering	3/1 ex		3	Orendáč
Mathematics I.	4/3 ex		8	
Computers and Programming I.	2/2 ex		5	
Technical Documentation in EE	2/1 ca		3	Ďurovský
Theoretical El. Engineering	3/3 ex		7	Špaldonová
Mathematics II.		3/3 ex	7	
Computers and Programming II.		2/2 ex	5	
Electrical Measurement		2/2 ex	5	
Electronics		3/3 ex	7	
Physics		3/2 ex	6	Ziman
Foreign Language:	0/2 ca	0/2 ca	-	
EA I. in duration of		4 weeks	4	
Required number of credits			60	

Second Year

Duration: 14 + 14 weeks + 6 weeks Praxis II.

Option Subject	Semester: 3rd Lect./Lab.	4th Lect./Lab.	N° of credits	Lecturer
Economics	2/2 ex		3	
Electrical Machines	4/3 ex		7	Kostelný
Power Electronics I.	3/3 ex		6	Dudrík
Microprocessor Technology	2/2 ex		4	Girman
Computers in Electrical Engineering I.	2/3 ex		5	Girman
Electrical Machines and Apparatus		3/3 ex	6	Kostelný, Fedor J.
Power Electronics II.		3/3 ex	6	Dudrík
Computers in Electrical Engineering II.		2/3 ex	5	Girman
Electrical Drives		4/4 ex	8	Timko
Economics		2/2 ex	3	
Foreign Language	0/2 ex		2	
EA II. in duration of		6 weeks	5	
Required number of credits			60	

Third Year

Duration: 14 + 14 weeks

Option Subject	Semester: 5th Lect./Lab.	6th Lect./Lab.	N° of credits	Lecturer
Compulsory Subjects				
Business and Management Studies I.	2/2 ca		5	
Power Engineering I.	2/2 ex		5	Ilenin
Final Project	0/2 ca		2	
Optional Subjects (students choose min. 3 subjects)				
Automatic Control of Drives I.	3/3 ex		8	Tomko
Power Semiconductor Systems I.	3/3 ex		8	Dudrík
Electrical Drives Design	2/2 ex		5	Milly
Control Systems in Industrial Lines	2/2 ex		5	Girman
Robots and Manipulators	2/2 ex		5	Fetyko
Compulsory Subjects				
Business and Management Studies II.		2/2 ca	5	
Power Engineering II.		2/2 ex	5	Kolcun
Final Project		0/7 ca	7	
Optional Subjects (students choose min. 2 subjects)				
Automatic Control of Drives II.		3/4 ex	8	Fetyko
Power Semiconductor Systems II.		3/3 ex	8	Ondera
Industrial Drives		2/2 ex	5	Tomko
Control of Quality and Reliability		2/2 ex	5	
Required number of credits			60	

Abbreviations: ex = exam, ca = continuing assessment

3.3 PhD. (Postgraduate) Course (3 years)

Students with a Master's Degree (Ing.) can apply for a postgraduate course lasting three years. According to the Notice No 131 of the Ministry of Education of Slovak Republic, the PhD. study continues in the branch of study 26-32-9 Electrical Engineering, particularly in one from the following specialisation:

- Electrical Drives.
- Electrical Machines and Apparatus.
- Power Electronics.

The postgraduate program is divided into two parts. After 18 months there is a defence of an overview work on topic of the dissertation accompanied by an exam from the specialised subjects chosen by the supervisor. The further study is concentrated on research only. The course is finished by a public defence of the dissertation in the end of the third year.

4. Current Research Projects

The research activity at the Department of Electrical Drives is generally concentrated on

- CAD of electrical machines and apparatus,
- controlled electrical drives,
- power electronics converters with improved dynamic properties,
- applications of control theory and computers to control of complex drive systems, multi-motor drives of manufacturing lines, industrial plants and robots,
- microcomputer implementation of control algorithms.

Scientific research is carried out in collaboration with national authorities and industry. The following research projects were carried out at the Department in 1997 year:

1.	Control of Drives for Vibration Equipment.
2.	Special Electrical Drives of Low Power Rating.
3.	Development of Control Algorithms for Non-Linear and Multi-Motor Drives.
4.	Advanced Control Methods in Field of Industrial Automation.
5.	Power Semiconductor Converters with Reduced Switching Losses.
6.	Control of Multi-Motor Electromechanical Systems.

1. Control of Drives for Vibrating Machines

Supported by grant N° 2323/95 of the Grant Agency for Science (VEGA).
Duration: 1995 - 1997
Co-ordinator: Jaroslav Tomko (66 %)
Members: František Ďurovský (66 %), Jozef Fedor, Želmíra Ferková, Vladislav Maxim (66 %), Dionýz Milly (66 %), Ladislav Zboray (66 %),
PhD. students: Le Quang Duc, Tibor Takáč

Goals of the project: To find a suitable drive for various applications of vibrating machines and mills and to design suitable control circuits for them.

Research activity of the group is concentrated on:

- design of switched reluctance motor of rating power 3 kW and nominal revolutions 3000 rev./min.,
- choice of a commercially produced converter with possibility of its adjusting for supplying of the SRM,
- design and adjusting of the position sensor of the rotor of SRM,
- design and production of trajectory sensor of vibrating movement,
- mathematical model of the vibrating machine,
- design and verification of the control structure in order to check possibilities to change a trajectory of a vibrating movement.

Results achieved in 1997:

- derivation of a methodology for designing the SRM,
- derivation of a mathematical model of a vibration mill,
- Compensation and activation of the centrifugal forces by electrical drive in the system DC motor-vibration machine – theoretical derivation and practical verification,
- development of the theory of state control of non-linar system,
- methodology of identification of parameters of vibrating machine for purpose of its simulation.

Publications: [J2], [C2], [C3], [D1], [H2], [H3], [H4], [H5]

2. Special Electrical Drives of Low Power Ratings

Research project N° 41152 based on institutional granting.
Co-ordinator: Michal Kostelný
Members: Bartolomej Fedor, Ján Kaňuch, Miroslav Tvrdoň, Pavel Záskalický

Goals of the project: To design and investigate properties switched reluctance and step motors.

Research activity of the group is concentrated on:

- development and realisation of the switched reluctance motor (SRM) with axial magnetic field,
- development of a step motor with axial magnetic field,
- design of new structures of switched reluctance and step motors,
- optimisation of switching processes; calculation of currents and torque.

Results achieved in 1997:

- debugging a program to calculate the motor with axial magnetic field for various configurations,
- electromagnetic design of SRM with axial magnetic field and optimisation of disc dimensions,

- theoretical design of linear switched reluctance motor with simple and double rotor,
- general theory on unsymmetrical structures SRM and step motors,
- optimisation of switching at low speed: analytical calculation of currents and torque by linearisation of the magnetic curve.

Publications: [C8], [C9], [C10], [C11]

3. Development of Control Algorithms for Non-Linear and Multi-Motor Drives

Supported by grant N° 1/4025/97 of the Grant Agency for Science (VEGA).
Co-ordinator: Pavol Fedor
Members: Stanislav Fedor, Rastislav Harčarufka, Katarína Harčarufková, Daniela Perduková

The project deals with two basic topics:
- Methodology of control circuit design for one- and multi-motor drives, synthesis of regulators for asynchronous motor drives using Lyapunow theory and applying fuzzy regulators to control the drives.
- Development of environment for control systems based on transputer network. Design and debugging of software tools for modelling, monitoring and control of complex drive systems.

Results achieved in 1996:
- design and debugging of the transputer module and reserved memory,
- software for observing the intensity of communication in multi-processor system,
- methodology of design of controller type for DC and AC drives.

Publications: [M1], [S1], [S2], [K1]

4. Advanced Control Methods in Field of Industrial Automation

Supported by grant N° 1/3204/96 of the Grant Agency for Science (VEGA).
Duration: 1996 - 1998
Co-ordinator: Jaroslav Timko
Members: Dušan Balara, Pavol Fedor (50 %), Marcela Halušková, Peter Bober, Michal Girman, Peter Košč, Dobroslav Kováč (33%), Irena Kováčová (66%), Daniela Perduková (50%), Jaroslava Žilková

Goals of the project: To adapt the modern control methods (fuzzy controllers, neural networks, adaptive controllers and controllers with variable structures) to chosen industrial drives.

Research activity of the group is concentrated on:
- applications of neural networks in control and identification of electrical drives,
- control of AC drives,
- modernisation of converters considering the electromagnetic compatibility.

Results achieved in 1997:
- state differential method for learning of artificial neural networks,
- control of the drive by variables structures,
- control of technological lines with incomplete access to state variables,
- dynamic control of drives with synchronous motor,
- measurement and modelling of power semiconductor devices and inverters,
- influence of higher harmonics to accuracy of measurements by measuring transformers,
- identification of non-linear systems using the artificial neural networks.

Publications: [S3], [S4], [J1], [C1], [C6], [C7], [C12]

5. Power Semiconductor Converters with Reduced Switching Losses

Supported by grant N° 1/3210/96 of the Grant Agency for Science (FEI code 9440).
Duration: 1996 - 1998
Co-ordinator: Jaroslav Dudrík
Members: Jozef Ondera, Imrich Pokorný, Peter Višnyi
PhD. student: Peter Dzurko

Goals of the project: To develop, investigate and verify connection of converters for various applications while taking into considerations decrease of switching losses in power semiconductor devices working at high frequencies.

Research activity of the group is concentrated on:
- design and development of a three-phase frequency converter with the resonant link,
- debugging of models of indirect DC converters,
- design and realisation of laboratory prototype of DC converter with possibility to modify various structures and different control methods.

Results achieved in 1997:
- development of a special multi-purpose generator for control of converters,
- design and verification of basic properties of an indirect DC converter,
- laboratory verification of a series-parallel resonant dc-dc converter for arc welding,
- development of a switch-mode power supply for halogen lamps.

Publications: [H1]

6. Control of Multi-Motor Electromechanical Systems

Supported by grant N° 1/3203/96 of the Grant Agency for Science (FEI code 9439).
Duration: 1996 - 1998
Co-ordinator: Ján Fetyko (33 %)
Members: Ján Čverčko (VSŽ Oceľ, Košice), František Ďurovský (33%), Viliam Fedák, Vladislav Maxim (33%), Dionýz Milly (33%), Jaroslav Tomko (33%), Ladislav Zboray (33 %),
PhD. student: Martin Frena

Goals of the project: To develop and adapt the modern control theory (non-adaptive, adaptive and optimal state control methods) for multi-motor electromechanical systems (robots, manipulators and continuous technological lines).

Research activity of the group is concentrated on:

- setting-up of models for chosen electromechanical systems (continuous strip finishing rolling mill, processing lines and robot with 6 degrees of freedom),
- development of modern control methods for multi-motor electromechanical systems,
- verification of designed control structures,
- comprehensive preparation of the topic.

Results achieved in 1997:

- setting-up a mathematical model and debugging of the simulation model of the chosen subsystems of the technological lines with continuous web: model of strip line, feed rollers, stretch and dancing rolls, continuous annealing and tinning lines,
- synthesis of adaptive state control of drives with feed-forward correction.

Publications: [J2], [C2], [C4], [C5], [H1], [H2], [H4], [H5]

5. Publications in 1997

1. Monographies

[M1] Fedor, P. – Perduková, D.: Utilisation of the 2nd Lyapunow Method in Controlled Electrical Drives. Košice, 1997, 89 p., ISBN 80-967 636-3-6 (in Slovak)

1. Teaching Books and Teaching Materials

[S1] Harčarufka, R. – Harčarufková, K. et all: The Fundamentals of the Working in Internet and Intranet. Course material for flexible education prepared within the PHARE-TEMPUS S_JEP 11 366-96, 102 p. (in Slovak)

[S2] Harčarufková, K. – Perduková, D. – Žilková, J. et all: Text Editor MS Word. Course material for flexible education prepared within the PHARE-TEMPUS S_JEP 11 366-96, 102 p. (in Slovak)

[S3] Šimko, V. - Kováčová, I. – Kováč, D.: MS WORD 7. Book. ELFA, s.r.o., 1997, 102 p., ISBN 80-88786-60-6 (in Slovak)

[S4] Šimko, V. - Kováčová, I. – Kováč, D.: Modelling of Converters. Book. ELFA, s.r.o., 1997, 112 p., ISBN 80-88786-61-4 (in Slovak)

2. Papers in Specialised Journals

[J1] Timko, J. – Halušková, M.: Variable Structure Double-Motor Control. Acta Technica CSAV 42 (1997), pp. 311-318

[J2] Zboray, L.: State Control of Unity-Power Factor Converters. Journal of El. Engineering, 48 (1997), No 9-10, pp. 245-249

3. Contributions at International Conferences

[C1] Balara, D.: Neural Networks Based Parametric Identification of Electrical Drives. In: Proc. of "Int. Conf. of PhD. Students", University of Miskolc, 1997, Sect. Proc. on Eng. Science", pp. 24-31

[C2] Ďurovský, F. – Tomko, J. – Čverčko, J. – Karásek, L. Control of Thin Coating In Electrolytic Tinning Line, In: Proc. of "the 2nd Conf. on Electrical Drives in Metallurgy Eng., HNE'97", Czestochowa, 1997, pp. 24-35 (in Slovak)

[C3] Fedor, J.: Source of Short-Circuit Current. In: Proc. of the Int. Conf. SEKEL'97", STU Bratislava, 1997, pp. 30-32 (in Slovak)

[C4] Fetyko, J. - Tomko, J. - Čverčko, J. - Vranec, J.: Control of Drives of a Part of Continuous Annealing Line. In: Proc. of "the 2nd Conf. on Electrical Drives in Metallurgical Engineering, HNE'97", Czestochowa, 1997, pp. 36-44 (in Slovak)

[C5] Fetyko, J.: State Feed-Forward Control of Servodrives for Robots. In: Proc. of the Int. Conf. "Robotics in theory and practice, ROPBTEP '97", Prešov, pp.265-268 (in Slovak)

[C6] Kováč, D. – Kováčová, I.: Measuring System Controlled by PC. In: Proc of the "Int. Computer Science Conference, microCAD'97", Miskolc 1997, Section E, pp. 85-88

[C7] Kováčová, I. – Šimko, V.: Applicability of a High Voltage Measurement Transformer for Non-Harmonic Signal Measuring. In: Proc. of the Int. Conf. on "Advanced Methods in the Theory of Electrical Engineering, AMTEE '97", Univ. of West Bohemia, 1997, pp. 199-202

[C8] Tvrdoň, M.: Optimisation of the Thickness of the Rotor Disc of SRM with Axial Magnetic Field. In: Proc. of the Int. Conf. SEKEL'97", STU Bratislava, 1997, pp. 95-97 (in Slovak)

[C9] Záskalický, P. – Farid Meibody-Tabar: Modelling of a Claw, Permanent Magnet Synchronous Motor, Minimisation of the Torque Ripple. In: Proc. of „the XXXIII Int. Symposium of Electrical Machines, Poznań, Poland, 1997, pp. 105-108

[C10] Záskalický, P.: Synchronous Machines with the Permanent Magnets. In: Proc. of the Int. Conf. SEKEL'97", STU Bratislava, 1997, pp. 132-135 (in Slovak)

[C11] Záskalický, P. – Záskalická M.: Experiences from Study at the ENSEM – Nancy, France. In: Proc. of the Int. Conf. SEKEL'97", STU Bratislava, 1997, pp. 132-135 (in Slovak)

[C12] Žilková, J.: Neural Observer of the Magnetic Flux in the Asynchronous Motor. In: Proc. of the Int. Conf. SEKEL'97", STU Bratislava, 1997, pp. 136-138 (in Slovak)

Contributions at Domnestic Conferences and Seminars

[K1] Fedor, P.: Automation of the Asphalt Precoated Plants. In: Proc. of the specialised seminar of the IS, a.s. Košice company. The High Tatras, 1997, 7 p. (in Slovak)

4. Other publications

Defended Theses

[D1] Maxim V: Steady - State and Transient Analysis of Converter for SRM. Dissertation, TU Košice, 1997, 72 p. Supervisor: Juraj Oetter. (in Slovak)

Project Reports

[H1] Fetyko, J. – Pokorný, I.: Analysis of Torques of Drives for Tilting the Converter No 5. Project HZ 21-/0415/97 for VSŽ, a.s. TU Košice, 40 p. (in Slovak)

[H2] Fetyko, J. – Ďurovský, F.: Analysis and Design of Drives for Control of Conveyers, Fans and Pumps in the Coke-Owen Plant. Project No HZ 6/0415/97 for VSŽ,a s., Košice. TU Košice, 1997, 70 p. (in Slovak)

[H3] Tomko, J. – Milly, D. – Ďurovský, F. – Maxim, V. – Takáč, T.: Filtering and Compensating Station in DZ SVa (Cold Mill Factory). Study report. Project No HZ 3/0415/97 for VSŽ, a.s. Košice. TU Košice, 1997, 60 p. (in Slovak)

[H4] Tomko, J. – Fetyko, J. - Ďurovský, F. – Milly, D. - Maxim, V. et all: Simulation of Dynamical States of Chosen Industrial Lines in Cold Mill Factory. Project No HZ 3/0415/97 for VSŽ, a.s. Košice. TU Košice, 1997, 51 p. (in Slovak)

[H5] Tomko, J. – Fetyko, J. - Ďurovský, F. et all: Cold Two-Mill Tandem Line (a study for reconstruction of the two-moll tandem line). Project No HZ 13/0415/96 for VSŽ Oceľ, s.r.o., TU Košice, 1997, p. (in Slovak)

6. Students Works in 1996/97

6.1 Graduate Theses (Diploma Works)

- **Power Electronics**

1. Burda, J.: A Laboratory Equipment for Teaching the Subject Control Electronics
   Adviser: Kováčová, I.
2. Dzurko, P.: Resonant Converter for Arc Welding
   Adviser: Ondera, J.
3. Ferenčík, O.: Design of a Laboratory DC-DC Resonant Converter
   Adviser: Ondera, J.
4. Herák, D.: Control System for an Indirect DC Converter
   Adviser: Višnyi, P.
5. Habušta, M.: Control of Small Piezoelectric Motors
   Adviser: Kovalčin

6. Kováč, F.: Design of Switched Supply for Charger of Accumulators
   Adviser: Ondera, J.
7. Molčák, Ľ.: Design of Connection, Software and Realisation of an Universal PID Controller Based on uP 8031
   Adviser: Kováč, D.
8. Pozemková, M.: Converters with Improved Power Factor
   Adviser: Krahulík, P.
9. Šimco, M.: Laboratory Control System for Net Converters
   Adviser: Višnyi, P.

- **Electrical Drives**

1. Alexi, K.: Arrangement of the Siemens' Converters for Teaching Aids
   Adviser: Ďurovský, F.
2. Bandurčin, Ľ: State Control of a Crane
   Adviser: Zboray, L.
3. Dančej, M.: Modelling of Electrical Machines using Artificial Neural Networks
   Adviser: Žilková, J.
4. Gaľaš, P.: Control of the Voltage Starter for Asynchronous Motor of the Type NOREG
   Adviser: Tomko, J.
5. Gramata, R.: Debugging of Teaching Programmes in MAPLE
   Adviser: Ďurovský, F.
6. Husár, P.: Position Control with and Asynchronous Motor
   Adviser: Ďurovský, F..
7. Jaroščák, P.: Control of Drives of Two-Mill Tandem in VSŽ
   Adviser: Fetyko, J.
8. Koteleš, Sz.: Control of a Drive with AM using the Variable Structures Method
   Adviser: Timko
9. Nálepka, E.: Control of Drives for Rollers in the Furnance Section of a Continuous Annealing Line
   Adviser: Fetyko, J.
10. Ňachaj, D.: Control of an Educational Robot MA 2000
    Adviser: Fetyko, J.
11. Šoltýs, M.: Control of Drives of the Preparation Line in VSŽ
    Adviser: Tomko, J.

- **Electrical Machines and Apparatus**

1. Belko, P.: Claculation of Currents and Torques of the SRM
   Adviser: Záskalický, P.
2. Devečka, P.: Calculation of tthe Force and Torque in Electrical Machines
   Adviser: Kostelný, M.
3. Dubjel, P.: Asynchronous Linear Motor
   Adviser: Ferková, Ž.
4. Pallai Bilý, J. Thermal Calculation of the Asynchronous Motor using PC
   Adviser: Kaňuch, J.
5. Pustelník, J.: A Source of the Short-Circuit Current
   Adviser: Fedor B.

6. Suchý, L.: Design of a Three-Phase Air Transformer using PC
Adviser: Ferková, Ž.
7. Šandrej, M.: Analysis of a Rotor Magnetic Flow Component in a Small One-Phase Sychronous Motor
Adviser: Záskalický, P.
8. Tomko, J.: Source of the Alternating Current
Adviser: Fedor, J.
9. Veľas, D.: Design of a Linear SRM
Adviser: Tvrdoň, M.

- **Automation of Electrical Equipment**

1. Barla, M: Design of Control of an AC Drive using PLC
Adviser: Fedor P.
2. Fejka, J.: Graphic Interface for Development of Application and Configuration of the Automatised Generating Systems GAUS
Adviser: Bober, P.
3. Jahoda J.: Fuzzy Controller for Washing Machine Drive
Adviser: Fedor, S.
4. Choboda, M: Optimisation of Communication Ways in the Controlling System
Adviser: Girman, M.
5. Koman, P.: Simulation of Dynamical Systems
Adviser: Girman, M.
6. Majer, J.: Modul of the System PC 104 for Connecting the Magnetostriction Range Measurement
Adviser: Haluška, J.
7. Šulek, M.: A Communication Protocol between a Visualisation Program CONTROL PANEL and PLC
Adviser: Perduková, D.
8. Vávra, M. Investigation of Fuzzy Controller Properties for Non-Linear Systems
Adviser: Fedor, P.

6.2 Students' Scientific Reports

The International Students' Scientific Conference was held in Bratislava on 23-24 June, 1997. Three students' reports from the Department were presented there. The contributions were published in the Proceedings „Electrical Engineering'97 Conference", Slovak Technical University, Bratislava, 1997:

1. Jaroščák, P.: Control of Drives of Two-Mill Tandem — Adviser: Tomko
2. Ondrejka, M.: The fluorescent Lamps Supplied by Converters — Adviser: Ondera
3. Dzurko, P.: Converter for Arc Welding with Resonant Inverter — Adviser: Dudrík

7. Information about Staff Members

1. Fields of Research Interests of the Teaching Staff Members

Jaroslav Timko, Professor (Prof. Ing., CSc.)
Control of AC drives (also linear ones) fed by power electronic frequency converters. Applications of neural networks in electrical drives.

Ladislav Zboray, Professor (Prof. Ing., CSc.)
Non-linear state control methods and their application to the control design of drive systems.

Jaroslav Dudrík, Associate Professor (Doc. Ing., CSc.)
Analysis, design and control of static power converters. High-frequency resonant and soft switching DC/DC converters.

Viliam Fedák, Associate Professor (Doc. Ing., CSc.)
Application of the advanced control theories for control of single- and multi-motor drives. Systems identification. Modelling of electromechanical systems.

Jozef Fedor, Associate Professor (Doc. Ing., CSc.)
Switching electrical circuits and switching apparatus. Applications of power semiconductor devices and circuits for a switching techniques.

Pavol Fedor, Associate Professor (Doc. Ing., CSc.)
Software for control and new control methods of electrical drives, parallel and distributed programming and application software for transputer system.

Ján Fetyko, Associate Professor (Doc. Ing., CSc.)
Control of electrical drives. Electric servosystems for robots Non-adaptive and adaptive control of industrial robots. Mechatronics

Irena Kováčová, Associate Professor (Doc. Ing., CSc.)
Modern power semiconductor switching devices (MOSFET, IGBT, PIN diodes) and their application in power converters.

Michal Kostelný, Associate Professor (Doc. Ing., CSc.)
Design of electrical machines, esp. switched reluctance motors of various types (with radial and axial air-gap).

Jozef Ondera, Associate Professor (Doc. Ing., CSc.)
Design and control of power semiconductor converters. Design of direct-current converter. Applications of converters for illuminating engineering and battery chargers.

Imrich Pokorný, Associate Professor (Doc. Ing., CSc.)
Inverters with and without DC line. Design of resonant inverters. Back influence on supplying lines and higher harmonics elimination in output voltages and currents.

Jaroslav Tomko, Associate Professor (Doc. Ing., CSc.)
Modern methods of electrical drives control. Adaptive systems with time delay. Electrical drives for technological lines and vibration machines.

Pavel Záskalický, Associate Professor (Doc. Ing., CSc.)
Structures of reluctance step motors. Linear theory of reluctance motors. Optimisation of supply and power losses calculation.

František Ďurovský, Assistant Professor (Ing., CSc.)
Control of electric drives, esp. state-space control. Design of non-linear observers. Design and debugging of programs for digital control of electrical drives.

Bartolomej Fedor, Assistant Professor (Ing., CSc.)
Switching of electrical circuits, switching devices and equipment. Application of power semiconductor devices in switching circuits.

Stanislav Fedor, Assistant Professor (Ing.)
Computer control. Surface-mounting and hybrid technologies. Design of measuring instruments for testing and diagnostic of energetic devices.

Želmíra Ferková, Assistant Professor (Ing., CSc.)
Magnetic fields in electrical machines, esp. in switched reluctance motors.

Rastislav Harčarufka, Assistant Professor, (Ing.)
Software for real-time systems with parallel or distributed architecture, based on conventional processors and/or transputers, CAD, CASE -technologies, parallel programming, and languages.

Ján Kaňuch, Assistant Professor (Ing.)
Design of disk step motor and disk reluctance motor. Application of CAD methods in design of electrical machines and devices.

Iveta Kochová, Assistant Professor (Ing.)
Electrical machines, special electrical machines.

Vladislav Maxim, Assistant Professor (Ing., CSc.)
Design of power components for switched reluctance drives (SRD). Analysis of SRD using PC. Simulating in Pspice.

Dionýz Milly, Assistant Professor (Ing., CSc.)
Frequency converters with sinusoidal input and output currents. Control circuits for power converters. Power factor compensation. Switched sources.

Juraj Németh, Assistant Professor (Ing.,
Models of frequency controlled AC machines, esp. with field vector oriented control. Control of electrical drives for vibration machines.

Daniela Perduková, Assistant Professor (Ing., CSc.)
Design methods and control structures for multi-motor drives. Model reference control systems.

Miroslav Tvrdoň, Assistant Professor (Ing.)
Switched reluctance motors with disc rotor. Magnetic fields solution using finite elements method.

Jaroslava Žilková, Assistant Professor (Ing.)
Applications of neural networks in electrical drives.

2. Fields of Research Interests of Research Workers

Peter Višnyi, (Ing., CSc.)
Digital speed and position control of electric machines. Extremely high dynamic performance and precise electrical drives of small power.

Katarína Harčarufková, (Ing.)
Real-time and programming of industrial control systems. Computer-aided control application. New education technologies (flexible-distance education, computer-based learning, etc).

3. Supported and Technical Staff

Alena Jakabová	- technician
Katarína Gočová	- economist
Vasil' Graban, (Ing.)	- technician
Veronika Majerníková	- secretary

8. Current PhD. Students (in 1997/98)

Bandurčin Ľuboš
theme: Neural Networks Applications in Electrical Drives
supervisor: Ladislav Zboray

Dušan Balara, full-time PhD. student
theme: Neural Networks Applications in Electrical Drives
supervisor: Jaroslav Timko

Peter Dzurko, full-time PhD. student
theme: High-Frequency DC-DC Power Converter
supervisor: Jaroslav Dudrík

Martin Frena, full-time PhD. student
theme: Control of Multi-Motor Electromechanical Systems
supervisor: Viliam Fedák

Ján Gula, external form (VSŽ Košice)
theme: Control of Technological Lines using Neural Networks
supervisor: Jaroslav Timko

Tibor Takáč, full-time PhD. student
theme: Design of Vibrating Mill
supervisor: Jaroslav Tomko

Le Quang Duc, full-time PhD. student
theme: Control of a Drive with SRM for Vibrating Mill
supervisor: Jaroslav Tomko

Stanislav Fedor, Assistant Professor
theme: Fuzzy Controller with Disturbance Identification according to the Lyapunow Method
supervisor: Pavol Fedor

Juraj Németh, Assistant Professor
theme: State Control of a VSI-Fed Asynchronous Motor
supervisor: Jaroslav Tomko

Rastislav Harčarufka, Assistant Professor
theme: Fuzzy Control of Synchronous Motor Drive
supervisor: Pavol Fedor

Further postgraduates (having finished their study and writing thesis)

Čverčko Ján, external form (research worker, VSŽ Košice)
theme: Adaptive Control of Strip Elongation in the Finishing Cold Strip Mills
supervisor: Ján Fetyko

Kaňuch Ján, Assistant Professor
theme: Disc Step Motor with Axial Air - Gap
supervisor: Michal Kostelný

Tvrdoň Miroslav, Assistant Professor
theme: Switched Reluctance Motor with Axial Air Gap $2p_1/2p_2=6/4$
supervisor: Michal Kostelný

Jaroslava Žilková, Assistant Professor
theme: Control of AC Drive by Neural Network
supervisor: Jaroslav Timko

9. Teaching and Research Laboratories

At the Department there are 19 laboratories. They are used both for research and teaching. The most important are:

- two laboratories for teaching of general electrical engineering subjects,
- two specialised laboratories for power electronics and electronics,
- three computer laboratories for CAD design and simulation in electrical drives, power electronics and electrical machines (ANSYS, MATLAB, PSPice, and other programs),
- two specialised laboratories for electrical drives and servosystems based on industrial systems,
- three laboratories for electrical machines.

10. Other Activities

10.1 Membership in Other Organisations

1. International Professional Societies

- EPEA (European Power Electronics and Drives Association - Brussels): Fedák - member
- PEMCA (Power Electronics and Motion Control Association - Budapest) - established in 1996: Fedák, Timko - members of the committee

2. Members of the Programme and Steering Committees of the International Conferences

- PEMC'98, Praha: Timko (vice-chairman), Fedák, Fedor J.

3. National Professional Bodies and Societies

- Joint Slovak Board for the PhD. Study in Electrical Engineering: Timko (vice-chairman), Fedák, Fedor J., Zboray - members
- Technical Standards Commissions: Ferková (Electrical Machines), Pokorný (Electrical Devices and Measurement)
- Grant Agency for Technology: Fedák
- SES (Slovak Electrotechnic Society): Fedák, Fedor, J., Fetyko, Kaňuch, Kováčová, Ondera, Pokorný, Timko, Tomko, Záskalický, Zboray - members.

10.2 Seminars, Conferences and Meetings

1. Scientific Seminars at the Department

Each month a scientific seminar is organised by the Department where the results achieved in research and the results of works of PhD. students are presented. Some seminars were organised in co-operation with the Slovak Electrotechnical Society they were led by specialists from industry - in order to disseminate information about the current state and advances in industry.

2. High-Tech Workshop, Herľany 1997

In May the Eighth Scientific Workshop on Advances in Industrial Control was successfully organised by staff members (Harčarufka, Perduková) in the re-training centre of the Technical University in Herľany, near Košice. The workshop has already got a tradition among our graduates and was devoted to exchange the knowledge between the departmental staff and industrial specialists.

3. Participation in Conferences and Meetings

- Int. Meeting of University Teachers of Electrical Machines. TU of Košice (13 -15 Jan.) - Kostelný, Ferková, Kaňuch, Tvrdoň, Záskalický

- Int. Conference microCAD'97, University of Miskolc, Hungary, (26 Feb.) - Fetyko
- Int. Workshop on „Mechatronic Courses", organised within the project TEMPUS S-JEP-07374, University of Miskolc, Hungary, (12 June) - Fedák, Fedor J., Fetyko
- Int. Workshop on „Integrated Energy Engineering Programmes with European Studies" organized within the project TEMPUS S-JEP-07286, University of Miskolc, Hungary, (30 June – 2 July) - Fedák, Fedor J., Fetyko
- the XXXIII Int. Symposium of Electrical Machines, Poznaň, Poland (8 – 12 June) - Záskalický P.
- Int. Conference of PhD. Students, University of Miskolc, Hungary (11-17 August) - Balara D., granted by VEGA proj. No 9420
- Int. Meeting of University Teachers in General Electrical Engineering, SEKEL'97, Kočovce, (9-11 Sept.) - Fedor J., Záskalický
- Info Day of the programme ESPRIT, Prague (21 – 22 Sept.) - Harčarufka R.

4. Short Specialised Courses - External Lectures

In 1997 year the Department continued with short 1-3 days specialised courses prepared for participants from industry. Continuing from the previous year, there is already prepared a series of almost 20 topics covering the most modern aspects in electrical engineering, incl. utilisation of various CAD programs in electrical engineering, modern power semiconductor devices, effective power semiconductor converters, advanced control methods of electrical drives, industrial electrical drives, applications of signal processors in control circuits, modelling and simulation, etc.

10.3 International Co-operation

1. International Projects

- **Teaching and Training in Electrical Drives and Machines Automation for Under- and Post-Graduate Students**

  CEEPUS Network Project No BG-7:
  Period: 1996 - 1997
  Co-ordinator (Sofia): Prof. Dr. Eng. Roman Litchev
  Co-ordinator (Wroclaw): Prof. Dr. Teresa Orlowska-Kowalska
  Subco-ordinator (Košice): Viliam Fedák
  Organisations involved: TU of Sofia (Dept. of Electrical Drives and Automation), TU of Wroclaw (Inst. of El. Machines and Drives), TU of Košice (Dept. of El. Drives)
  Objective: Implementation of optimised continuous modern and efficient teaching/training process in electrical drives and machine automation

- **Use of Modern Computer Methods in the Electrical Engineering Education**

  CEEPUS Network Project No SK-14
  Co-ordinator (Bratislava): Prof. Ľudovít Klug
  Subco-ordinator (Košice): Michal Kostelný
  Organisations involved: TU of Košice (Dept. of El. Drives), Slovak TU Bratislava (Dept. of El. Machines and Devices), TU Budapest (Dept. El. Machines), Silesian TU of Gliwice (Dept. of El. Machines), University of Ljubljana (Dept. of El. Machines)
  Objective: Exchange of experiences with utilisation modern methods in education and research in Electrical Machines, Power Electrical Engineering, High Voltage Technique, Electromagnetic Compatibility and Testing Methods. Solution of ecological problems, magnetic fields in electrical machines by FEM, solution of electromagnetic compatibility.

The staff members are also involved in the following project co-ordinated by the Technical University of Košice:

- **Flexible Learning and Continuing Education, "FLACE"**:
  TEMPUS S_JEP-11366-96
- **Strategic University Management in Administration, SUMA"**:
  TEMPUS S_JEP-11304-96
- **Professional Improvement of Management in Administration, "PRIMA"**
  TEMPUS S_JEP-11274-96

2. Visits to Foreign Institutions

- SIEMENS Erlangen, Germany (6-9 May) - Tomko J., Ďurovský F., Maxim V. - visit of the enterprise accompanying a group of students.

3. Study Stays Abroad

- Open Universities in Hagen, Herlen and Oxford (13 – 21 April) - Harčarufka R. Granted by TEMPUS S_JEP 11 366/96
- Silesian Technical University of Gliwice (3 – 30 June) - Ferková Ž. Granted by the project. Granted by the project CEEPUS SK-14
- University of Gent, Belgium (23 June – 6 July), Harčarufka R. Granted by TEMPUS S_JEP 11 304-96

4. Foreign Visitors

Staff:

- Tivadar J. Szarka, University of Miskolc, Hungary
- Gavris Mihai, Helga Silaghi, Marius Silagi, University of Oradea, Romania (22 Oct.)
- Ivan Georgijev Kostov, Technical University of Sofia, Bulgaria (2 April - 1 May)

Students:

- Sigrid Jacobsen from Norwegian University of Technology and Science, Trondheim, Norway (9 June - 18 July)

10. Joint Projects with Industry

1. Control Systems for Precoating of the Asphalt Mixtures in Veľká Lomnica and Kvetnica. ARTEP, a.s., Košice. Co-ordinator: Fedor P. Grant: 53 000 Sk
2. Configuration of the Control System ROSEMOUNT RS-3 in Bukóza Vranov. REGULA, a.s. Košice. Co-ordinator: Fedor P.
3. Information System for MAYTEX in Liptovský Mikuláš. REGULA, a.s. Košice. Co-ordinator: Fedor P.
4. Control System for Power Energy Unit in Power Station Vojany. REGULA, a.s. Košice. Co-ordinator: Fedor P. Grant 227.000 Sk (incl. previous 2 projects)
5. Filtrating and Compensating Station in DZ Sva (Cold Mill Factory). Study report No 3/0415/97, VSŽ Košice. Co-ordinator: Čverčko, J. Subco-ordinator: Tomko J. Grant 225 000 Sk
6. Simulation of Dynamical States of Chosen Industrial Lines in Cold Mill Factory, VSŽ Košice. Project No HZ 13/0415/96. Co-ordinator: Tomko J. Grant: 225 000 Sk
7. Cold Two-Mill Tandem Line (a study for reconstruction of the rolling line). Project HZ 13/0415/96. Co-ordinator: Čverčko, J. Subco-ordinator: Tomko J. Grant: 160 000 Sk
8. Analysis of Torques of Drives for Tilting the Converter No 5. Project HZ 21-415 for VSŽ,a.s. Co-ordinator: Fetyko J. Grant: 58 300 Sk
9. Analysis and Design of Drives for Control of Conveyers, Fans and Pumps in the Coke-Owen Plant. Project HZ 6/0415/97 for VSŽ,a s., Košice. Co-ordinator: Fetyko J. Grant: 84 800 Sk

Direct Contact to Staff Members and PhD. Students

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