**Institute of the Theory of Electrical
Engineering, Measurement and Information Systems**

# REPORT 2003

**Department of Electrical Engineering
Warsaw University of Technology**

**Warsaw University of Technology**

**Institute of the Theory of Electrical Engineering, Measurement and Information Systems**

# ANNUAL REPORT OF SCIENTIFIC ACTIVITY IN 2003

**WARSAW, 2003**

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# SCIENTIFIC ACTIVITY OF THE INSTITUTE

1. OPTIMIZATION AND INVERSE PROBLEMS IN ELECTROMAGNETC FIELD THEORY
- J. Sikora, S. Wincenciak, J. Starzyński, J. Korytkowski, B. Sawicki, R. Szmurło, P. Rowiński, M. Chojnowski

Problem of analysis of electromagnetic fields, problem oriented language for field analysis; nonstandard elements for finite element method; neural network technique for mesh generation; pre- and postprocessing for data and results (visual presentation including animation); electric thermal coupled fields and eddy current problems (3D). Synthesis, efficient techniques for sensitivity analysis; the optimization algorithms for nonlinear problems; identification of source functions and boundary conditions (application for computerized electrocardiography); optimal shape design; material derivative approach for optimal shape design; material structure identification. Computer modeling of the brain, simulation of magnetic stimulation of the brain.

2. ELECTRICAL IMPEDANCE TOMOGRAPHY
- J. Sikora, S. Filipowicz, Z. Filipowicz, K. Nita, M. Stasiak

Artificial Neural Network (ANN) and sensitivity approach in application to inverse problem solution for electrical impedance tomography, algorithms of learning adjusted to impedance tomography, 2D and 3D tomography, applications of tomography in different branches of engineering.

3. MATHEMATICAL MODELS DESCRIBING THE INTERACTION OF THE COUPLED FIELDS ON CONTINUOS MEDIA
- S. Krzemiński, M. Śmiałek, A. Iwańska

Constitutive modeling of the interaction of the electromagnetic fields and moving electrodynamic media, methods of homogenization of nonuniform structures, analysis of the interaction of the electromagnetic fields and mobile non-Newtonian, electrically conducting fluids moving in the channels of the peristaltic walls, problems of magneto- and electrodynamic flows. Mathematical model of MHD shock wave propagation.

4. SYNTHESIS AND OPTIMIZATION OF POWER ELECTRONIC CIRCUITS
- K. Mikołajuk, Z. Filipowicz, A. Toboła, S. Kwiczak

Synthesis of passive switching circuits, theory of LC switching one-ports and two-ports, creation of new thyristor and transistor switching structures, particularly DC-DC converters, power electronic harmonic compensators, optimization of harmonic reduction in electrical power system, optimal placements of compensators, combinatorial optimization methods - simulated annealing algorithms, Boltzman machines, signal processing oriented on the measurements in electronical power systems, wavelet approximation.

5. RESEARCH IN THE AREA OF NEURAL NETWORKS

- S. Osowski, A. Cichocki, K. Siwek, R. Sałat, T. Markiewicz, Tran Hoai Linh, B. Świderki, A. Wiliński

Study of the properties and applications of neural networks (n.n.); development of new learning rules; methods of learning using global optimization algorithms, simulated annealing and genetic algorithms - applications in the field of electrical engineering; feedforward and recurrent dynamic n.n.; optimization using n.n., adaptive signal processing using n.n.; identification and estimation of signals for signal processing systems using n.n.; application of n.n. in synthesis and design of electrical circuits, location of faults - application of feedforward and Kohonen networks, data compression, predictive properties of neural networks - application to load prediction of power electro-energetic system, neural fuzzy systems - study of self-organizing and supervised learning rules and application in identification and prediction; blind separation and deconvolution of signals - development of new effective learning rules and its applications, PCA neural networks - learning algorithms and applications; diagnosis of the systems using neural networks and signal preprocessing based on FFT and wavelet theory; biological and biomedical signal processing using neural networks. Fuzzy neural networks – learning theory and applications, SVM neural networks for classification and regression.

6. STUDY OF SINGULAR MULTIVARIABLE AND PARAMETER DISTRIBUTED SYSTEMS - DIRECT AND INVERSE PROBLEMS

- Z. Trzaska

Effective algorithms and computational procedures for analysis, synthesis, identification and design of singular dynamical multivariable systems; analysis and design of manipulators; studies of systems with distributed parameters; criogenic systems, fault diagnostic systems, geometrical approaches to dynamical system problems, electrical car drives; fundamentals and applications of the Fibonacci hyperbolic trigonometry and Fibonacci polynomials; direct and inverse problem solutions for 2-D and N-D systems.

7. SIMULATION OF POWER SYSTEM LOADED BY THE HIGH POWER NONLINEAR LOAD

- W. Brociek

Modeling of the elements of power system, interaction of the system and nonlinear load of quickly changing parameters (arc furnaces, traction substations), electromagnetic compatibility of the high power nonlinear load and power system in dynamic conditions, analysis of higher harmonics using simulation languages including PCNAP and PCSPICE, quality of the delivered energy under non-sinusoidal conditions.

8. SYNTHESIS AND IDENTIFICATION OF PARAMETERS OF THE CURRENT CIRCUIT OF THE IMPULSE PLASMA GENERATOR

- T. Karwat

Analytic and experimental investigation leading to the identification of the electrical parameters of the plasma generator, mathematical description of the plasma chamber, quality

of the titanium nitride coating of the cutting instruments in the process of thermal - chemical treatment performed in the plasma chamber and its connection with the electrical parameters of the plasma. Magnetic shielding of physical objects.

9. RESEARCH IN THE AREA OF TEMPERATURE TRANSDUCERS OPTIMIZATION
- J. Czajewski

Development of new generation of temperature transducers based on wide range of sensors, metal resistors, semiconductor resistors termo- couples, junction elements, microcomputer's method of linearization, simulation and hardware implementation.

10. RESEARCH IN THE AREA OF METHODS AND SYSTEMS FOR TESTING MAGNETIC MATERIALS
- J. Olędzki

Parameter identification approach to magnetic material testing, adaptive techniques in testing magnetic materials, e.g. adaptive control of demagnetization, of measurement process, adaptive digital synthesis of magnetizing current waveform. Methods of identification of two- and three-terminal networks in the harmonic current circuits when model accuracy in a frequency range is specified, computer parameter identification supplemented with an automatic selection of a model structure of adequate accuracy.

11. MAGNETIC FIELD MEASUREMENTS AND THEIR APPLICATIONS
- S. Tumański, T. Winek

Sensors of magnetic fields, magnetic fields measurements, construction of magnetometers, measurements of power frequency magnetic and electric fields, nondestructive testing of electric steel sheets. Computer controlled measurement system of magnetic fields. Computer aided processing of measurement data.

12. RESEARCH IN THE AREA OF APPLICATION ON MIS STRUCTURES AS NONELECTRICAL QUANTITIES TRANSDUCERS
- B. Moeschke

Analysis of the relation between physical quantities, particularly mechanical and semiconductor materials, application of semiconductors, monocristalic and policristalic structures and p-n structures as non-electric quantities transducers, application of MIS-structures as non-electric quantities measurement transducers, experiments with selected structure, designing non-electric quantities transducer with MIS structure and joint-structure.

13. RESEARCH IN THE AREA OF FLOW MEASUREMENTS IN OPEN CHANNELS
- A. Michalski, A. Kalicki, M. Suproniuk

Study of the features of electromagnetic method, development of new generation of electromagnetic flow meter dedicated for industrial open channels, optimization of primary transducer (coil, electrodes) based on the finite element idea and generalized Newton algorithm, designing small measurements systems based on one chip microcomputers. Measurement algorithms and signal processing for electromagnetic flow meters.

14.RESEARCH IN THE AREA OF HIGH RESOLUTION SPECTRAL ANALYSIS, CODING AND ESTIMATION
- Z. Staroszczyk, R. Rak, D. Sawicki, A. Majkowski, A. Jóśko

Interpolating FFT methods for distorted signals measurements, power systems measurement and identifications, parametric spectral estimation of noisy signals, transfer function measurements, digital filters applications to high resolution spectral analysis, vector quantization of FFT spectrum, two dimensional spectrum/signal presentation.

15.VIRTUAL INSTRUMENTATION AND DISTRIBUTED MEASUREMENT SYSTEMS
- R. Rak, A. Majkowski, T. Winek

Development and design of virtual instruments (VI) equipped with modern procedures of digital signal processing (FFT, Wavelets). Distributed virtual measurement systems, implementation of VI-s in Ethernet and/or Internet based measurement systems.

# II. PUBLICATIONS

The results of the scientific activity of the Institute of the Theory of Electrical Engineering and Electrical Measurements, Warsaw University of Technology have been published in 28 journal papers (13 in international journals of Philadelphian list and 15 in other, either national or international journals), and 66 contributions of the proceedings of the national (22) and international (44) conferences. Below there is a list of papers published in 2003 as well as list of books written by the scientific staff of the Institute.

## 1. PAPERS IN SCIENTIFIC JOURNALS (alphabetical order)

### ▪ International journals of Philadelphian list

1. P. Baudoin, Y. Houbaert, **S. Tumański** – Magnetic local investigations of non-oriented electrical steels after tensile deformation, Journal of Magnetism and Magnetic Materials, v.254-255 (2003), pp. 32-35
2. K. Brudzewski, **S. Osowski, T. Markiewicz**, Classification of milk by means of an electronic nose and SVM neural network, Sensors and Actuators **– B**, 2003, vol.
3. J. Cao, N. Murata, S. Amari, **A. Cichocki**, T. Takeda: A robust approach to independent component analysis of signals with high-level noise measurements, *IEEE Transactions on Neural Networks*, vol. 14, 2003, pp. 631-645.
4. S. Choi, **A. Cichocki**, L. Zhang, S. Amari: Approximate maximum likelihood source separation using the natural gradient, IEI*CE Trans. Fundamentals*, vol. E86-A, no. 1, Jan. 2003, pp. 206-214.
5. **A. Cichocki**, P. Georgiev: Blind Source Separation Algorithms with Matrix Constraints , *IEICE Trans. Fundamentals,* vol. E86-A, no. 3, March 2003, pp. 522-531.
6. P. Georgiev, **A. Cichocki**, Robust Independent Component Analysis via Time-Delayed Cumulant Functions, IEI*CE Transactions on Information and Systems,* Special session on Independent Component Analysis and Blind Source Separation, pp. 573-579.
7. R.R Gharieb, **A. Cichocki**, Second-order statistics based blind source separation using a bank of subband filters, D*igital Signal Processing*, vol. 13, 2003, pp. 252-274.
8. Y. Li, **A. Cichocki**, L. Zhang, *Blind separation and extraction of binary sources*, *IEICE Transactions on Fundamentals*, vol. E86-A, no. 3, 2003, pp. 580-589.
9. **A.Michalski, J. Starzyński, S. Wincenciak**, "A Novel Approach to Eliminating Short Ending Effects in the Primary Transducer of Electromagnetic Flow Meter", *IEEE Transactions on Magnetics*, vo. 39, no 2 March 2003, pp. 1035-1039
10. **A.Michalski,** A.Chwaleba, "Instrumentation Notes – Mathematical Approach to Tremor Recognition in Extrapyramidal Disese" *IEEE Instrumentation & Measurement Magazine*, March 2003, vol. 6 No. 1, pp. 57- 61.
11. **A.Michalski**, J-Cl. Puippe, Instrumentation Notes – Surface Area Measurement by Diffusion-Limited Current, IEEE Instrumentation & Measurement Magazine, vol.6 no 3, September 2003, pp.70 – 75
12. **S. Osowski, L. Tran Hoai**, On-line heart beat recognition using Hermite polynomials and neuro-fuzzy network, IEEE Trans. on Instrumentation and Measurements, 2003, vol. 52, pp. 1224-1231
13. **S. Tumański** – Investigations of the anisotropic behaviour of SiFe steel, Journal of Magnetism and Magnetic Materials, v.254-255 (2003), pp. 50-53

## ▪ Other journals

1. S. R. Arridge, **J. Sikora, S. Filipowicz**, O pewnych aspektach metody elementów brzegowych w zastosowaniach do tomografii impedancyjnej i optycznej, Zeszyty Naukowe Politechniki Szczecińskiej, Szczecin, 2003, ss. 17-22,
2. **W. Brociek**, R. Wilanowicz, **K. Siwek**, Electric power quality parameters in transformer station supplying nonlinear load, Przegląd Elektrotechniczny, 11/2003, pp. XX
3. **S. Filipowicz., K. Nita,** R. Sikora**, J. Sikora,** Scanner application to fully automated measurements in Electrical Impedance Tomography, Przegląd Elektrotechniczny, R. LXXIX 10/2003, pp. 687-689
4. S Mukhametshina-Kalitska, **A. Kalicki**, Optymalizacja połączeń próbników w systemie badania jakości sieci telekomunikacyjnej metodą wyboru losowego - cz. I. Charakterystyki statystyczne systemu badawczego, Pomiary w telekomunikacji, Nr 21, ISSN 1425-7629, str. 83-95, Telekomunikacja Polska, 2003
5. **S. K. Krzemiński, M. Śmiałek, A. Iwańska**, Numerical Simulation of MHD Blood Flow Using Object Oriented Technology, Przegląd Elektrotechniki, Nr 11. 2003, pp. 865-868
6. **A. Michalski**, J. Sienkiewicz, Z. Watral , Ocena wpływu wymiarów przetwornika pierwotnego na rozkład pola megnetycznego w przepływomierzu elektromagnetycznym, Biuletyn WAT vol. LII, nr 04, 2003 ss. 5 – 26.
7. **A. Michalski**, J. Sienkiewicz, P. Trzaskawka, Z. Watral, Primary transducer for electromagnetic flow meters for open channels – two dimensional design procedures in a restricted area of calculation, Metrology and Measurement Systems, vol. X, no 2/2003, Warszawa 2003, pp. 173 – 190
8. **K. Mikołajuk, Z. Staroszczyk**, Time-frequency approach to analysis of time varying dynamic systems. Przegląd elektrotechniczny, 10'2003, pp.764-768
9. **J. Olędzki, S. Tumański,** Pomiary indukcji magnetycznej w blachach elektrotechnicznych metoda igłową, Przegląd Elektrotechniczny, v.79 (2003), 163-166
10. **S. Osowski**, R. Sałat, Transformacja PCA w zastosowaniu do diagnostyki obwodów, Zeszyty Nauk. Pol. Szczecińskiej, 2003, ss. 189-194
11. R. Sałat, **S. Osowski, K. Siwek**, Principal Component Analysis for feature selection at the diagnosis of electrical circuits, Przegląd Elektrotechniczny, 2003, No 10, pp. 667-670
12. **B. Sawicki, J. Starzyński, S. Wincenciak**, Application of $\vec{T}-\Omega$ Nodal FEM for Low-conducting Domains with Conducting Implants, Przegląd Elektrotechniczny, No.10, 2003, pp. 681-684
13. **S. Tumański**, Which magnetizing circuit is suitable for two-dimensional measurements?, PTB Berichte, v. PTB-E-81 (2003), pp. 151-157
14. **S. Tumański**, Investigations of two-dimensional properties of selected electrical steel samples by means of the Epstein method, PTB Berichte, v. PTB-E-81 (2003), pp. 221-227
15. **Z. Trzaska**, On strange attractors for discrete models of long transmission line, Part 2, Results of computer simulations and strange attractors, Archives of Electrical Engineering, Vol, LII, Nr 1, 2003, pp. 3-20

# 2. CONFERENCE PROCEEDINGS REPORTS,

## ▪ International conferences recognized by KBN

1. P. Berowski., **S. Filipowicz., J. Sikora**, CPU Time Reduction in BEM Using Discrete Wavelvet Transform, Computational Problems of Electrical Engineering, Jazleevets, Ukraine, Aug. 26-29, 2003, pp. 145- 148,
2. P. Berowski, **S. Filipowicz., J. Sikora**, Wavelet based techniques for CPU time reduction in BEM, XII International Symposium on Theoretical Electrical Engineering, ISTET'03, Warsaw, 2003, pp. 199-202
3. **W. Brociek**, R. Wilanowicz, Voltage distortion in the power station with nonlinear load, XII International Symposium on Theoretical Electrical Engineering ISTET'03, July 6 – 9, 2003, Warsaw, Poland, pp.453-456
4. **W. Brociek**, R. Wilanowicz, K. Siwek, Determination of electric power quality parameters in transformer station supplying nonlinear load: experimental and numerical study, V International Workshop "Computational Problems of Electrical Engineering" (CPEE 2003), Jazłowiec, Ukraina, 26-29.08.2003, pp. 141-144.
5. A. Cichocki, Semi-blind extraction and decomposition of multi-sensory signals-recent trends and perspective, *Proc. of XIII Int. Symposium on Theoretical Electrical Engineering (ISTET03)*, Warsaw, Poland, 2003, pp. 1-20.
6. **A. Cichocki**, Blind signal processing in application to biomedical signals, images and time series analysis: models and learning algorithms, *From Quanta to Societies: Proceedings of 2nd European Interdisciplinary School on Nonlinear Dynamics for System and Signal Analysis (EUROATTRACTOR 2001)*, Pabst Science Publishers, Lengerich, Germany, 2003, pp.107-122.
7. S. A. Cruces-Alvarez, **A. Cichocki**, Combining blind source extraction with joint approximate diagonalization: Thin algorithms for ICA , Proc. of Fourth IEEE International Symposium on Independent Component Analysis and Blind Signal Separation, April 1 - 4, 2003, Nara, Japan, pp. 463-469.
8. S**. Filipowicz., K. Nita,** R. Sikora**, J. Sikora**, Scanner application to fully automated measurements i Electrical Impedance Tomography, XII International Symposium on Theoretical Electrical Engineering, ISTET'03, Warsaw, July 6-9, 2003, pp. 469-472,
9. **S. Filipowicz., K. Nita, Ł. Oskwarek**, Investigation of the Influence of the Measurement on the image quality in the EIT, V International Workshop " Computational Problems of Electrical Engineering, Jazleevets, Ukraine, Aug. 26-29, 2003, pp. 51-54,
10. Giza Z., **S. Filipowicz., J. Sikora,** Simulated Annealing Method in Electrical Impedance Tomography, in the book Recent Development in Theories & Numerics (First Int. Conference on Inverse Problems '03 of Hong Kong), World Scientific 2003, pp. 336-348
11. J. Karvanen, **A. Cichocki**, Measuring sparseness of noisy signals, Proc. of Fourth IEEE International Symposium on Independent Component Analysis and Blind Signal Separation, April 1 - 4, 2003, Nara, Japan, pp. 125-131.
12. T. Karwat, **T. Karwat**, Investigation of screening efficiency of the magnetic field, generated by distribution board, Vth International Workshop, Computational Problems of Electrical Engineering, Ukraina-Jazłowiec, 26-29.08.2003, pp. 149-152
13. **S. Krzemiński, M. Śmiałek, A. Iwańska**, Numerical simulation of MHD blood flow using object oriented technology, Proc. ISTET Conference, pp. 175-178, Warszawa, 2003
14. **S. Krzemiński,** Symetryzacja układu równań Maxwella-Naviera-Stokesa, V International Workshop " Computational Problems of Electrical Engineering, Jazleevets, Ukraine, pp. 26-29, 2003,

15. Y. Li, **A. Cichocki**, Sparse representation of images using alternating linear programming, Proc. of 7th IEEE International Symposium on Signal Processing and Its Applications *(ISSPA2003)*, Tampere, Finland, 2003, pp. 57-60.
16. Y. Li, **A. Cichocki**, Non-negative matrix factorization and its application in blind sparse source separation with less sensors than sources, *Proc. of XIII Int. Symposium on Theoretical Electrical Engineering (ISTET03)*, Warsaw, Poland, 2003, pp. 285-288.
17. Y. Li, **A. Cichocki**, S. Amari: Sparse Component Analysis for Blind Source Separation with Less Sensors Than Sources, Fourth IEEE International Symposium on Independent Component Analysis and Blind *Signal Separation*, April 1 - 4, 2003, Nara, Japan, 2003. pp.89-94.
18. Y. Li, **A. Cichocki,** L. Zhang: Blind Deconvolution for Binary Sources: A Grouping Decision Approach, *IEEE International Conference on Acoustics, Speech and Signal Processing*, Hong Kong, 2003.
19. **T. Markiewicz, S. Osowski, L.** Moszczyński, Myelogenous leukemia cell image preprocessing for feature generation, V Int. Workshop "Computational Methods in Electrical Engineering, Jazłowiec, Ukraina, 2003, pp. 70-73
20. **K. Mikołajuk, Z. Staroszczyk**, Time-frequency approach to analysis of time varying dynamic systems, XII Int. Symp. On Theoretical Electrical Eng. (ISTET), 2003, Warsaw Poland, pp. 81-84
21. **K. Mikołajuk, Z. Filipowicz, A. Toboła**, Synthesis of Switching 2-ports with Prescribed Loading , V Int. Workshop Computational Problems of Electrical Engineering, August 26-29, Jazleevets, Ukraine, pp. 129-131
22. **K. Mikołajuk, Z. Staroszczyk**, Periodical variability in power systems - time and frequency approach, Sixth Int. Workshop on Power Definitions and Measurements under Non-Sinusoidal Conditions, Milano, October 13-15, 2003, pp. 57-62
23. **S. Osowski, L. Tran Hoai**, Integration of neural networks for reliable classification, Int. Symposium on Theoretical Electrical Engineering, ISTET'03, 2003, Warsaw, pp. 49-52
24. S**. Osowski,** R. Sałat**, K. Siwek**, Detection of switching events in the circuits using wavelet decomposition, IEE European Conference on Circuit Theory and Design,ECCTD'03, Kraków, 2003, pp. I 121-124
25. P. Pyszlak, **R. J. Rak, A. Majkowski**, „The next approach to the design of a Web-Based Virtual Laboratory", IEEE Instrumentation and Measurement Technology Conference, Vail, USA, 2003.
26. P. Pyszlak, **R. Rak** „The design of a Web-Based Virtual Laboratory – selected problems", World Congress IMEKO, Dubrownik, czerwiec 2003
27. R. Sałat, **S. Osowski, K. Siwek**, PCA transformation for feature selection at the diagnosis of electrical circuits, Int. Symposium on Theoretical Electrical Engineering, ISTET'03, 2003, Warsaw, pp. 105-108
28. R. Sałat, **S. Osowski**, Analog filter diagnosis using Support Vector Machine, IEE European Conference on Circuit Theory and Design, ECCTD'03, Krakow, 2003, pp. III 421-424
29. **B. Sawicki, J. Starzyński, S. Wincenciak**, Application of T-Omega Nodal FEM for Low-conducting Domains with Conducting Implants. XII. International Symposium on Theoretical Electrical Engineering ISTET'03, Warsaw, July 6-9, 2003, pp. 325-328.
30. **B. Sawicki, J. Starzyński, S. Wincenciak**, Computer Simulation of Human Body Exposition to ELF Electromagnetic Field. Proceedings of the V International Workshop "Computational Problems of Electrical Engineering'', Jazleevets, Ukraine, August 26-29 2003, ISBN 83-916444-2-1, pp. 29-31.
31. **B. Sawicki, J. Starzyński, S. Wincenciak**, A. Krawczyk, M. Trlep, Magnetic Stimulation of Knee – Mathematical Model. ISEF 2003 – 11th International Symposium on

Electromagnetic Fields in Electrical Engineering, Maribor, Slovenia, September 18-20, 2003, pp. 901-906

32. **D. Sawicki**, Luminance Map Visualization, ISPA'03 Third International Symposium on Image and Signal Processing and Analysis, Rome, Italy, September, pp. 18-20, 2003
33. R. Sikora, **J. Sikora, S. Filipowicz**., Z. Giza, M. Stasiak, Identification of Cracks in Copper Mines by Bell Functions Approximation in Electrical Impedance Tomography, 3rd World Congress on Industrial Process Tomography, Banff, Canada, Sep. 2-5, 2003, pp. 724-729
34. Stasiak M., **J. Sikora, S. Filipowicz**, Reduction of measurements in 3D Electrical Impedance Tomography using strategically placed electrodes, V International Workshop " Computational Problems of Electrical Engineering, Jazleevets, Ukraine, Aug. 26-29, 2003, pp. 55-58
35. M. Stasiak, **K. Siwek, Filipowicz S.,** R. Sikora**, J. Sikora**, Principal Component Analysis Application as a Highly Efficient 3D Electrical Impedance Tomography Alternative Solution, 3rd World Congress on Industrial Process Tomography, Banff, Canada, Sep. 2-5, 2003, pp. 664-670,
36. **J. Starzyński, B. Sawicki, R. Szmurło, S. Wincenciak**, Numerical Simulation of Electric and Magnetic Brain Stimulation. Materiały Konferencji COMPUMAG 2003 - 14th Conference on the Computation of Electromagnetic Fields, July 13-17, Saratoga Springs, New York, USA, pp. I 72-73, 2003.
37. **J. Starzyński, S. Osowski, S. Wincenciak**, Support Vector Machines - a Promising Tool for Optimal Design of Electromagnetic Devices. Materiały Konferencji COMPUMAG 2003 - 14th Conference on the Computation of Electromagnetic Fields, July 13-17, Saratoga Springs, New York, USA, pp. II 116-117, 2003.
38. **S. Tumanski**, Overview and introduction in XMR technologies (Invited paper), Proceedings of 7th International Symposium "Magnetoresistive Sensoren", Sensitec - Wetzlar, 2003, 1-7
39. **S. Tumanski**, Design and optimization of the C-type magnetizing yoke, Digest of 16th Conference "Soft Magnetic materials", Dűsseldorf, 2003, Paper T 6-10
40. **S. Tumanski**, W. Pluta, M. Soinski – Analysis of magnetic field distribution in the sample of RSST device, Digest of 16th Conference "Soft Magnetic materials", Dűsseldorf, 2003, Paper T 6-09
41. **S. Tumanski**, A. Liszka – Analysis of magnetic field distribution in C-yoke system, Proceedings of 11th International Symposium in Electromagnetics&Mechanics, ISEM'03, Paryż-Wersal, 2003, 124-125
42. **Z. Trzaska**, Numerical Aspects of Skew-Symmetric Spectral Family of Operations In Hilbert Spaces, The 7th World Multiconference on Systemics, Cybernetics and Informatics, July 27-30, 2003, Orlando, Florida, USA, Proceedings, Vol, XIV, Computer Science, Engineering Applications, pp. 168-173
43. **Z. Trzaska**, Identyfikacja procesu rewersji pola magnetycznego, V International Workshop "Computational problems of Electrical Engineering", Jazleevets, Ukraina, August 26-29, 2003, Proceedings, pp. 19- 23
44. **Z. Trzaska**, Properties and Applications of Skew-Symmetric Systems, ISTET'03, Warsaw, 2003, pp. 206-210

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# III. KBN GRANTS

1. Projekt badawczy KBN Nr 8 T10A 047 21, „Metody analizy i identyfikacji pola elektromagnetycznego w strukturach słabo przewodzących", Czas trwania projektu 2001-2003 – Kierownik projektu - dr inż. Starzyński
2. Projekt badawczy KBN Nr 8 T10A020 20, „Elektromagnetyczna tomografia procesowa niskiej częstotliwości dla potrzeb techniki i biologii", Czas trwania projektu 2001-2003, Kierownik projektu - prof. J. Sikora
3. Projekt badawczy KBN Nr 8 T190C 025 20 – „Metody i urządzenia do badania blach elektrotechnicznych w postaci próbek arkuszowych", Czas trwania 1.04.2001 – 31.03.2004, Kierownik projektu - prof. S Tumański
4. Projekt badawczy KBN Nr 8 T10A 005 21, Zastosowanie sieci neuronowych do diagnostyki układów elektrycznych i elektroenergetycznych, (grant promotorski), Czas trwania 1.08.2001 – 31.07.2003, Kierownik projektu - prof. S. Osowski
5. Projekt badawczy KBN Nr 8 T10A 009 21, „Aplikacje nowoczesnych metod analizy sygnałów w wirtualnych przyrządach pomiarowych", Czas trwania 1.09.2001 – 31.12.2003, Kierownik projektu - prof. R. Rak
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8. Projekt badawczy KBN Nr 4T10A 041 23, „Nowe metody rekonstrukcji obrazu w tomografii impedancyjnej i optycznej”, Czas trwania 2002-2004, Kierownik projektu – prof. J. Sikora

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2. **Łukasz Oskwarek**, „*Metodyka doboru parametrów i struktury wielopunktowego systemu pomiarowego do tomografii impedancyjnej*”, Politechnika Warszawska, 25.09.2003, (promotor: **dr hab. R. Rak**)

3. **Bartosz Sawicki**, „*Modelowanie prądów wirowych w środowisku słaboprzewodzącym z wykorzystaniem wektorowego potencjału elektrycznego* ***T”,*** Politechnika Warszawska, 2003 (promotor **prof. S. Wincenciak)**

# V. INTERNATIONAL COOPERATION

1. Socrates project, Cooperation with Germany, Finland, France, England, Belgium, Italy.
2. Cooperation with Lvov Technical University (Ukraine)