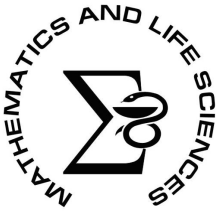

Mathematics for Life Sciences

September 3 – 14, 2012

Kyiv 2012

This workshop aims at overcoming the barriers between mathematics and the biosciences by discussing important existing and potential new applications of mathematical techniques. The morning sessions will consist of series of tutorial lectures from a mathematical and a life science perspective and aimed at non-specialists from both fields. In the afternoon sessions all participants will have the opportunity to present their own ongoing research to the interdisciplinary audience in shorter contributed talks.

The meeting is an event of the EC-funded project EU-Ukrainian Mathematicians for Life Sciences (EUMLS), yet it is open to all interested scientists with a mathematics or life science background, especially those at the early stages of their careers.

Organizing Committee:
Alexandra Antoniouk (Kyiv)
Jrgen Prestin (Lübeck)
Ewald Quak (Oslo)

Local Organizing Committee:
Alexandra Antoniouk
Anna Kyselova
Evgeniya Semenova

Dates: The workshop will take place in Kyiv, 3–14 September, 2012.
Location: The talks will take place in the Institute of Mathematics of National Academy of Sciences of Ukraine, situated in Kyiv, Tereshenkivska, 3.

April 2012 — March 2016
Funded by Marie Curie Actions — International Research Staff Exchange Scheme (IRSES)
FP7-People-2011-IRSES Project number 295164

Program

Monday, September 03	
14.00 — 21.00	**Registration** of participants at the Hotel „Kozatskiy“, Myhailivska str., 1/3 (Subway station „Maidan Nezalezhnosti“)

Tuesday, September 04	
09.00 — 10.00	**Registration** of participants in the room 208 at the Institute of Mathematics of NASU, Tereschchenkivska str. 3 (Subway station „Teatralna“)
10.00 — 10.30	**Opening**
Chairman	**J. Prestin**
10.30 — 11.30	**A. Redaelli, S. Vesentini, A. Gautieri** *Politecnico di Milano, Italy* From molecular dynamics to coarse graining models for the multiscale analysis of biomolecules — I
11.30 — 12.00	**Coffee break**
12.00 — 13.00	**K. Keller** *University of Lübeck, Germany* Nonlinear time series analysis — I
13.00 — 15.00	**Lunch**

Chairman	**K. Keller**
15.00 — 15.20	**Ie. Nastenko** *NTUU „KPI“* and *M. Amosov' Institute of Cardio-Vascular Surgery, Ukraine* Actual tasks of hemodynamics investigation in human circulatory system
15.20 — 15.40	**O. Kyselova, Ie. Nastenko** *NTUU „KPI“, Ukraine* Quantitative estimates of heart rate regularities as a reflection of circulatory system regulatory redundancy
15.40 — 16.00	**A. Kyselova** *NTUU „KPI“, Ukraine* Context-aware energy efficient control system
16.00 — 16.30	**Coffee break**
Chairman	**A. Antoniouk**
16.30 — 16.50	**T. M. Sørensen** *University of Oslo, Norway* Superconductors and magnetoencephalography
16.50 — 17.10	**Partner presentation:** **A. Redaelli** *Politecnico di Milano, Italy*
17.10 — 17.30	**R. Vismara** *Politecnico di Milano, Italy* In vitro study of the aortic valve
17.40	**Welcome party**

Wednesday, September 05	
Chairman	**E. Quak**
09.30 — 10.30	**K. Keller** *University of Lübeck, Germany* Nonlinear time series analysis — II
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**T. Mel'nyk** *Taras Shevchenko National University of Kyiv, Ukraine* Asymptotic analysis of boundary-value problems and spectral problems in domains with complex structure (thick fractal junctions, perforated domains, thin perforated domains) — I
12.00 — 13.00	**A. Redaelli, S. Vesentini, A. Gautieri** *Politecnico di Milano, Italy* From molecular dynamics to coarse graining models for the multiscale analysis of biomolecules — II
13.00 — 15.00	**Lunch**
Chairman	**T. Mel'nyk**
15.00 — 15.20	**O. A. Sivak** *Swansea University, UK* Asymptotic approximations for solutions to elliptic problems with different perturbed boundary conditions in perforated domains
15.20 — 15.40	**W. Erb** *University of Lübeck, Germany* Accelerated Landweber methods based on co-dilated orthogonal polynomials

15.40 — 16.00	**M. Piola, M. Soncini, F. Prandi, M. Pesce, G. B. Fiore** *Politecnico di Milano, Italy* Early arterialization phenomena in human saphenous bypass grafts studied ex vivo
16.00 — 16.30	**Coffee break**
Chairman	**S. Vesentini**
16.30 — 16.50	**M. Stevanella, E. Votta, A. Redaelli** *Politecnico di Milano, Italy* MRI-based left ventricle modelling for the prediction of ventricular function after revascularization
16.50 — 17.10	**V. A. Unakafova** *University of Lübeck, Germany* The relationship of permutation entropy and Kolmogorov-Sinai entropy
17.10 — 17.30	**A. M. Unakafov** *University of Lübeck, Germany* Permutation entropy of mixing Markov shifts
17.40	**Partner presentation:** **J. Prestin** *University of Lübeck, Germany* **A. Kyselova** *NTUU „KPI“, Ukraine*

Thursday, September 06	
Chairman	**Ie. Nastenko**
09.30 — 10.30	**J. Bjaalie** *University of Oslo, Norway* What is a brain?
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**T. B. Leergaard, S. C. Coello, J. Bjaalie** *University of Oslo, Norway* What is brain imaging? The fundamentals
12.00 — 13.00	**T. B. Leergaard, J. Bjaalie** *University of Oslo, Norway* What is brain atlasing?
13.00 — 15.00	**Lunch**
Chairman	**J. Bjaalie**
15.00 — 15.20	**A. Rößler** *University of Lübeck, Germany* Numerical methods for stochastic models in life sciences
15.20 — 15.40	**D. Henkel** *University of Lübeck, Germany* Optimal pointwise approximation of a stochastic evolution equation with additive noise
15.40 — 16.00	**A. Popov** *Taras Shevchenko National University of Kyiv, Ukraine* Asymptotic expansions of the eigenelements of Dirichlet spectral problem in thin perforated domains with rapidly varying thickness and different limit dimensions
16.00 — 16.30	**Coffee break**

Chairman	**A. Rößler**
16.30 — 16.50	**F. Consolo, S. Brizzola, F. Acocella, V. Grieco, G. B. Fiore, M. Soncini** *Politecnico di Milano, Italy* Tissue engineering in urology: a biomechanical and histological characterization of a dynamically perfused acellular bladder matrix
16.50 — 17.10	**V. Kalmykov, T. Romanenko, V. Vishnevskey** *Institute of Mathematical Machines and Systems, Ukraine* Spline approximation of the experimental data
17.10 — 17.30	**Ya. I. Grushka** *Institute of Mathematics of NASU, Ukraine* Changeable sets and mathematical modeling of the evolution of systems
18.00	**Banquet**

Friday, September 07	
Chairman	**T. B. Leergaard**
09.30 — 10.30	**J. Bjaalie** *University of Oslo, Norway* Trends in neuroinformatics
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**C. Coello** *University of Oslo, Norway* Segmentation in brain imaging
12.00 — 13.00	**C. Coello** *University of Oslo, Norway* Spatial normalization in brain imaging
13.00 — 15.00	**Lunch**
Chairman	**C. Coello**
15.00 — 15.20	**Yu. Yu. Fedchun, V. I. Gerasimenko** *Institute of Mathematics of NASU, Ukraine* Towards derivation of evolution equations of hemokinetics
15.20 — 15.40	**V. A. Mikhailets** *Institute of Mathematics of NASU, Ukraine* Interpolation with function parameter of abstract and function Hilbert spaces
15.40 — 16.00	**O. O. Murach** *Institute of Mathematics of NASU, Ukraine* Refined Sobolev scale and elliptic problems
16.00 — 16.30	**Coffee break**

Chairman	**V. I. Gerasimenko**
16.30 — 16.50	**V. Los** *Chernigiv State Technological University, Ukraine* Parabolic problems in a refined Sobolev scale
16.50 — 17.10	**A. M. Leopaldi, R. Vismara, L. Valerio, M. Lemma, C. Antona, G. Gelpi, A. Mangini, A. Redaelli, G. B. Fiore** *Politecnico di Milano, Italy* A novel *in vitro* passive beating heart platform for research, device testing and training
17.10 — 17.30	**L. Valerio, R. Vismara, C. Antona, A. Mangini, M. Contino, A. Redaelli, G. B. Fiore** *Politecnico di Milano, Italy* In vitro study of aortic valves treated with neo-chordae grafts: hydrodynamics and tensile force measurements
17.40	**Partner presentation:** **E. Quak** *University of Oslo, Norway*

Saturday, September 08	
Chairman	**V. A. Mikhailets**
09.30 — 10.30	**A. Redaelli, S. Vesentini, A. Gautieri** *Politecnico di Milano, Italy* From molecular dynamics to coarse graining models for the multiscale analysis of biomolecules — III
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**T. Mel'nyk** *Taras Shevchenko National University of Kyiv, Ukraine* Asymptotic analysis of boundary-value problems and spectral problems in domains with complex structure (thick fractal junctions, perforated domains, thin perforated domains) — II
12.00 — 13.00	**K. Keller** *University of Lübeck, Germany* Nonlinear time series analysis — III
13.00 — 15.00	**Lunch**
Chairman	**W. Erb**
15.00 — 15.20	**C. Paulick** *University of Lübeck, Germany* Decomposition of 3-way arrays: a comparison of different PARAFAC algorithms
15.20 — 15.40	**A. Pelosi, G. B. Fiore, A. Redaelli** *Politecnico di Milano, Italy* Design optimization of blood recirculating devices through computational fluid dynamics

15.40 — 16.00	**D. Yu. Sadovyj** *Taras Shevchenko National University of Kyiv, Ukraine* Homogenization of boundary-value problems in two-level thick junctions consisting of thin discs with rounded or sharp edges
16.00 — 16.30	**Coffee break**
17.00	**Kyiv city tour**

Sunday, September 09	
	Sightseeing tour to Chrenihiv

Monday, September 10	
Chairman	**A. Redaelli**
09.30 — 10.30	**K. Keller** *University of Lübeck, Germany* Nonlinear time series analysis — IV
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**S. V. Pereverzyev** *RICAM, Austria* A meta-learning approach to the regularized learning – case study: blood glucose prediction — I
12.00 — 13.00	**A. Redaelli, S. Vesentini, A. Gautieri** *Politecninco di Milano, Italy* From molecular dynamics to coarse graining models for the multiscale analysis of biomolecules — IV
13.00 — 15.00	**Lunch**
Chairman	**S. V. Pereverzyev**
15.00 — 15.20	**B. V. Bazaliy** *Institute of Applied Mathematics and Mechanics of NASU, Ukraine* Mathematical models of a tumor growth
15.20 — 15.40	**E. Votta, M. Stevanella, A. Redaelli** *Politecnico di Milano, Italy* Heart valve patient-specific numerical modeling for surgical planning
15.40 — 16.00	**S. Penka** *University of Lübeck, Germany* Multivariate frequency detection
16.00 — 16.30	**Coffee break**

Chairman	**B. V. Bazaliy**
16.30 — 16.50	**T. Belikova, V. Skobtsov, Yu. Skobtsov** *Institute of Applied Matematics and Mechanics of NASU, Ukraine* Evolutionary methods of ultrasonic medical images filtration
16.50 — 17.10	**N. Vasylyeva** *Institute of Applied Mathematics and Mechanics of NASU, Ukraine* On the two-phase free boundary problems for Laplace operator
17.10 — 17.30	**M. V. Voitovich** *Institute of Applied Mathematics and Mechanics of NASU, Ukraine* The Dirichlet problem for nonlinear fourth-order equations with strengthened coercivity and natural growth lower order terms
17.40	**Partner presentation:** **S. Maksymenko** *Institute of Mathematics of NASU, Ukraine* **B. V. Bazaliy** *Institute of Applied Mathematics and Mechanics of NASU, Ukraine*

Tuesday, September 11	
Chairman	**A. Gautieri**
09.30 — 10.30	**S. V. Pereverzyev** *RICAM, Austria* A meta-learning approach to the regularized learning – case study: blood glucose prediction — II
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**I. Nesteruk, J. H. E. Cartwright** *Institute of Hydromechanics of NASU, Ukraine* Mathematics and the mystery of dolphin swimming
12.00 — 13.00	**D. Langemann** *Technical University of Braunschweig, Germany* Robust mathematical models in life sciences — I
13.00 — 15.00	**Lunch**
Chairman	**I. Nesteruk**
15.00 — 15.20	**E. V. Semenova** *Institute of Mathematics of NASU, Ukraine* About optimal accuracy by fully discrete methods for solving Symm's equation in aposteriori case
15.20 — 15.40	**U. Foryś, M. Bodnar** *University of Warsaw, Poland* Generalized idea of Greenspan multicellular spheroid model for tumor growth
15.40 — 16.00	**M. J. Piotrowska, S. D. Angus** *University of Warsaw, Poland* A cellular automaton model of multicellular spheroids under irradiation

16.00 — 16.30	**Coffee break**
Chairman	**U. Foryś**
16.30 — 16.50	**T. S. Krasnopolskaya, E. D. Pechuk** *Institute of Hydromechanics of NASU, Ukraine* Reconstruction of dynamical system from synthetic electrocardiogram (ECG) signal
16.50 — 17.10	**A. Goriunov** *Institute of Mathematics of NASU, Ukraine* Shin–Zettl quasi-differential operators and boundary problems
17.10 — 17.30	**G. V. Kriukova** *National Scientific Centre for Medical and Biotechnical Research of NASU, Ukraine* On network extreme eigenvalue
17.40	**Partner presentation:** **G. V. Kriukova** *Taras Shevchenko National University of Kyiv, Ukraine* **I. Nesteruk** *Institute of Hydromechanics of NASU, Ukraine*

Wednesday, September 12	
Chairman	**A. N. Timokha**
09.30 — 10.30	**A. G. Kukush** *Taras Shevchenko National University of Kyiv, Ukraine* Methods of radiation risk estimation under uncertainty in doses
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**D. Langemann** *Technical University of Braunschweig, Germany* Robust mathematical models in life sciences — II
12.00 — 13.00	**S. V. Pereverzyev** *RICAM, Austria* A meta-learning approach to the regularized learning – case study: blood glucose prediction — III
13.00 — 15.00	**Lunch**
Chairman	**D. Langemann**
15.00 — 15.20	**A. N. Timokha** *Institute of Mathematics of NASU, Ukraine* Dynamic processes in cells and human body associated with sloshing
15.20 — 15.40	**S. V. Masiuk, S. V. Shklyar, A. G. Kukush** *Ukrainian Radiation Protection Institute, Ukraine* Estimation of radiation risk in the presence of measurement errors in exposure doses

15.40 — 16.00	**Y. A. Skobtsov, Y. V. Rodin, V. S. Overko** *Donetsk National Technical University, Ukraine* Simulation and visualization of the flow of blood in the human's vessels with pathologies
16.00 — 16.30	**Coffee break**
Chairman	**O. Kyselova**
16.30 — 16.50	**M. Rasponi, F. Piraino, G. B. Fiore, A. Redaelli** *Politecnico di Milano, Italy* Microfluidics for cell culture applications
16.50 — 17.10	**P. Occhetta, F. Piraino, N. Sadr, A. Redaelli, M. Moretti, M. Rasponi** *Politecnico di Milano, Italy* Microscale approaches to replicate in vitro the 3D cellular environment
17.10 — 17.30	**M. Yu. Savkina** *Institute of Mathematics of NASU, Ukraine* Mathematical background of the cytogenetical method of diagnosis of cancer of mammary gland
17.40	**EUMLS Future Activities**

Thursday, September 13	
Chairman	**S. Maksymenko**
09.30 — 10.30	**D. Langemann** *Technical University of Braunschweig, Germany* Robust mathematical models in life sciences — III
10.30 — 11.00	**Coffee break**
11.00 — 12.00	**S. V. Pereverzyev** *RICAM, Austria* A meta-learning approach to the regularized learning – case study: blood glucose prediction — IV
12.00 — 13.00	**D. Langemann** *Technical University of Braunschweig, Germany* Robust mathematical models in life sciences — IV
13.00 — 15.00	**Lunch**
Chairman	**T. S. Krasnopolskaya**
15.00 — 15.20	**S. Vesentini, A. Gautieri, A. Mezzanzanica, G. Salvadore, A. Senesi,** *Politecnico di Milano, Italy* Bridging the gap with GAGs: Molecular modeling of glycoproteins of the extracellular matrix
15.20 — 15.40	**A. Gautieri** *Politecninco di Milano, Italy* Multiscale modeling of biological and biomedical materials

15.40 — 16.00	**R. Bergmann** *University of Lübeck, Germany* The multivariate anisotropic wavelet transform on the torus
16.00 — 16.30	**Coffee break**
Chairman	**M. J. Piotrowska**
16.30 — 16.50	**A. I. Kazmerchuk** *Prycarpatian National university by Vasyl Stefanyk, Ukraine* Generalized bediagonal hyperbolic system of conservation laws
16.50 — 17.10	**I. A. Zhdanov, V. N. Govoruchin** *Southern Federal University, Russian Federation* Steady state solution flow of an ideal incompressible fluid through a rectangular channel
17.10 — 17.30	**A. A. Sorokina** *Southern Federal University, Rostov-on-Don, Russian Federation* Numerical investigation of erythroleukemia under spatial and temporal inhomogeneity
17.40	**Farewell party**

Friday, September 14
Departure

Plenary talks

J. G. BJAALIE

Trends in neuroinformatics

Neural Systems Laboratory, Institute of Basic Medical Sciences, University of Oslo, Norway

j.g.bjaalie@medisin.uio.no

The interdisciplinary field of neuroinformatics combines neuroscience with information science/technology and deals with the creation of the data systems that will be required to achieve such integration. The grand challenge in neuroinformatics is to achieve advanced, ultimately seamless, integration of all data needed to understand the nervous system. Neuroinformatics delivers technical capabilities making it easier for neuroscientists to analyze structural and functional brain data and to build and navigate multi-level brain atlases. Predictive neuroinformatics, closely coupled to modeling, is making it possible to detect statistical regularities in the relationships between data representing different levels of brain organization and to estimate the values of parameters that are difficult or impossible to measure experimentally. Overall, neuroinformatics tools will provide a new way of filling the gaps in data and knowledge that currently prevent us from achieving an integrated understanding of the brain.

J. G. BJAALIE

What is a brain?

Neural Systems Laboratory, Institute of Basic Medical Sciences, University of Oslo, Norway

j.g.bjaalie@medisin.uio.no

The mammalian brain is one of the most complex systems known. The brain is a massively complex information processing system with a hierarchy of different yet tightly integrated levels of organization, ranging from genes, proteins, synapses and cells to circuits, brain regions, and the whole brain. Today, we

know a lot about individual levels but much less about complex relationships across levels of investigation. Understanding brain function is a major challenge with implications for prevention and cure of brain diseases, and for future construction of new computing technologies that share the brains ability to operate on very little power, and to learn. In this lecture a short history of modern neuroscience is given with an emphasis on the principles of localization of function in the brain and functional organization of systems controlling sensory perception and motor action.

C. COELLO

Segmentation in brain imaging

Preclinical PET/CT Unit, Dept. of Anatomy, Univeristy of Oslo, Norway

christopher.coello@medisin.uio.no

Delineation of brain areas with similar anatomical and/or functional features is slowly shifting from being a manual task to an automatic one. Algorithms providing segmentation of brain areas based on MR volumes are numerous, spanning from simple region growing algorithm to Gaussian mixture model and multi-atlas based segmentation. In addition, simultaneous or sequential multi-modal acquisition of brain images makes it possible to combine information in order to obtain more accurate segmentation results. This talk will consist of a non-exhaustive review of these segmentation methods related to anatomical and functional brain imaging.

C. COELLO

Spatial normalization in brain imaging

Preclinical PET/CT Unit, Dept. of Anatomy, Univeristy of Oslo, Norway

christopher.coello@medisin.uio.no

Spatial normalization is defined as the mathematical process of transforming an experimental brain image/volume in its

native space into a standard space. This transformation can be linear or non-linear, depending on the similarities between the standard space and the native space. This talk will address the basic concept and actual techniques to achieve intra- and inter-modality normalization in brain imaging.

K. KELLER

Nonlinear time series analysis

University of Lübeck, Germany

keller@math.uni-luebeck.de

Nonlinear time series analysis is a fast developing research field with many different and, in particular, similar concepts and methods. The series of lectures is devoted to a discussion and comparison of well known and relatively new complexity measures, where both mathematical aspects and aspects of applications are considered. Here a central point is the description and estimation of Kolmogorov-Sinai entropy of a dynamical system.

A. G. KUKUSH

Methods of radiation risk estimation under uncertainty in doses

Taras Shevchenko National University of Kyiv, Ukraine

alexander_kukush@univ.kiev.ua

With a binary response Y, consider the *dose-response model* with $P(Y = 1|D) = R(1 + R)^{-1}$, $R = \lambda_0 + EAR \times D$, where λ_0 is the *baseline incidence rate* and EAR is *the excess absolute risk per gray.* The calculated thyroid dose of a person i is $D_i^{mes} = f_i^{mes} Q_i^{mes}/M_i^{mes}$. Here, Q_i^{mes} is the measured content of radioiodine in the thyroid gland of person i at time t_{mes}, M_i^{mes} is the estimate of the thyroid mass, and f_i^{mes} is the normalizing multiplier. Q_i is measured with *classical* additive error, so that $Q_i^{mes} = Q_i^{tr} + \sigma_{Q,i}^{mes}\gamma_i$, where $\{\gamma_i\}$ form Gaussian white noise and

standard deviation $\sigma_{Q,i}^{mes}$ is given. M_i is measured with *Berkson* multiplicative error V_i^M, so that $M_i^{tr} = M_i^{mes} V_i^M$. Here Q_i^{tr} is the true content of radioactivity in the thyroid gland, and M_i^{tr} is the true value of the thyroid gland. f_i is also contaminated with error. Introduce a new latent variable $\overline{D}_i^{tr} = f_i^{mes} Q_i^{tr} / M_i^{mes}$. The model of observations takes a form $D_i^{mes} = \overline{D}_i^{tr} + \varepsilon_i, D_i^{tr} = \overline{D}_i^{tr} V_i^D$. Here, ε_i are Gaussian classical additive errors with known variances, and V_i^D are log-normal Berkson multiplicative errors with known parameters. The variables $\overline{D}_i^{tr}$, ε_i, $V_i^D, i = 1, \ldots, N$ are mutually independent, and $\{\overline{D}_i^{tr}\}$ are i.i.d. *log-normally* distributed with unknown parameters. By means of Regression Calibration, Method of Moments, and SIMEX Method we investigate the influence of measurement errors in dose on the estimates of λ_0 and EAR. Simulation study is based on a real sample of thyroid doses from epidemiological data. The true risk parameters are given by the values of earlier epidemiological studies, and binary response variables are simulated according to the dose-response model.

The results are joint with Prof. R.J. Carroll and Dr. A. Bouville (USA) and Prof. I. Likhtarov and Doctors S. Shklyar, S. Masiuk, M. Chepurny and L. Kovgan (Kyiv).

D. LANGEMANN

Robust mathematical models in life sciences

Technical University of Braunschweig, Germany

d.langemann@tu-bs.de

In recent years, mathematical modeling became more and more important for life science applications. The models differ from models in physics or engineering, and an increasing variety of models are built of mechanisms which are not completely quantified. Often, only a selection of qualitative properties of these mechanisms are known. Nevertheless, mathematical models present a conceptual frame, and observations are discussed and understood within this frame.

We present typical examples of mathematical models using uncertain mechanisms like models for appetite regulation, inflammatory processes, resistance development, synaptic plasticity etc. We show that some robust implications can be found anyway, which are independent on the particular specification of the uncertain mechanisms.

Starting with these examples, we discuss theoretical aspects of modeling. Every admissible choice of mechanisms generates a mathematical model, and lacking parameters can be partly determined from known observations by parameter identification methods. Of course, uncertainties remain in the model. A model is called robust if its qualitative properties are independent of the remaining uncertainties. A further requirement on mathematical models is minimality.

The choice of a minimal model explaining all available observations in a family of admissible models expands parameter identification to model identification. A formalism is developped which introduces a hierarchy within the familiy of admissible models. Finally, this formalism is applied for the examples discussed above.

T. B. LEERGAARD, J. G. BJAALIE

What is brain atlasing?

Neural Systems Laboratory, Institute of Basic Medical Sciences, University of Oslo, Norway

t.b.leergaard@medisin.uio.no

The structural and functional organization of the brain has been charted for several centuries, resulting in various representations, or maps, reflecting the spatial characteristics of neuronal structures and brain systems. Brain maps and atlases are important for assigning spatial reference for the interpreting and comparing measurements derived from brains. Spatial reference frames provide valuable tools analyzing, communicating, and

integrating neuroscience data. In this lecture, we briefly review the history of brain atlasing, and present recent concepts in three-dimensional digital brain atlasing.

T. B. LEERGAARD, S. C. COELLO, J. G. BJAALIE

What is brain imaging? The fundamentals

Neural Systems Laboratory, Institute of Basic Medical Sciences, University of Oslo, Norway

t.b.leergaard@medisin.uio.no

Brain imaging tools are essential for clinical diagnostic and prognostic evaluation, and have contributed to numerous new discoveries in the field of neuroscience. We here briefly introduce key brain imaging methods and their application in clinical and basic neuroscience. We further illustrate the role of brain imaging techniques for advancing our basic understanding of the brain with selected examples of experimental preclinical brain imaging investigations in animal models.

T. MEL'NYK

Asymptotic analysis of boundary-value problems and spectral problems in domains with complex structure (thick fractal junctions, perforated domains, thin perforated domains)

Taras Shevchenko National University of Kyiv, Ukraine

melnyk@imath.kiev.ua

Asymptotic analysis is a theory of describing limiting behavior. The methodology has applications across several mathematical sciences. In the first lecture I will introduce basic definitions and concepts of asymptotic analysis. The following lectures will be devoted to asymptotic methods used to study boundary value problems in domains with complex structure (perforated domains, thin domains, thick fractal junctions).

I. NESTERUK [1], J. H. E. CARTWRIGHT [2]

Mathematics and the mystery of dolphin swimming

[1] *Institute of Hydromechanics of NASU, Ukraine*
[2] *Instituto Andaluz de Ciencias de la Tierra, CSIC-Universidad de Granada, Spain*

[1]inesteruk@yahoo.com, [2]julyan.cartwright@csic.es

The Navier-Stocks, Prandtl and Euler equations are applied to revise the turbulent drag estimate for a dolphin, presented by Gray 76 years ago, and so to resolve his paradox. We show that the boundary layer on a slender body of revolution differs significantly from that on a flat plate and the attached flow can remain laminar at larger Reynolds numbers. To illustrate that the body shape without flow separation is possible, an inverse problem was solved and experimental results are reported. Presented shapes should be of interest in order to diminish the total drag and noise of aero- and hydrodynamic hulls.

S. V. PEREVERZYEV

A meta-learning approach to the regularized learning – case study: blood glucose prediction

Johann Radon Institute for Computational and Applied Mathematics (RICAM), Austrian Academy of Sciences, Linz, Austria

sergei.pereverzyev@oeaw.ac.at

We are going to present a new scheme of a regularization kernel based learning method, where the kernel and the regularization parameter are adaptively chosen within the regularization procedure. The construction of such fully adaptive regularization learning (FARL) algorithm is motivated by the problem of predicting the blood glucose concentration of diabetic patients. We describe how the proposed scheme can be used for this purpose.

The scheme is now implemented in a device and tested in clinical trials performed within EU-project DIAdvisor

http://www.diadvisor.eu/. The results of these clinical tests will be also reported.

The presentation is based on the joint research with Valeriya Naumova (RICAM), Sivananthan Sampath (RICAM), Jette Randlov (Novo Nordisk A/S), and Samuel McKennoch (Novo Nordisk A/S).

The material is patent pending: the patent application EP 11163219.6 was filed jointly by Austrian Academy of Sciences and Novo Nordisk A/S (Denmark) on April 20, 2011. More details can be found in [1]–[3].

[1] Naumova, V.; Pereverzyev, S.V.; Sivananthan, S. *A meta-learning approach to the regularized learningcase study: Blood glucose prediction.* Neural Networks 33 (2012), 181-193. [2] Naumova, V.; Pereverzyev, S.V.; Sivananthan, S. *Extrapolation in variable RKHSs with application to the blood glucose reading.* Inverse Problems 27 (2011), 075010, 13 pp. [3] Sivananthan, S.; Naumova, V.; Dalla Man, C.; Facchinetti, A.; Renard, E.; Cobelli, C.; Pereverzyev, S.V. *Assessment of Blood Glucose Predictors: The Prediction-Error Grid Analysis*, Diabetes Technol Ther 13 (2011), 787–796.

A. REDAELLI [1], S. VESENTINI [2], A. GAUTIERI [3]

From molecular dynamics to coarse graining models for the multiscale analysis of biomolecules

Bioengineering Department, Politecnico di Milano, Italy

[1]alberto.redaelli@polimi.it, [2]simone.vesentini@polimi.it,
[3]alfonso.gautieri @polimi.it

Molecular modeling comprises a number of simulation tools, which helps the understanding of the fundamentals of many physical and chemical phenomena. This course is designed to introduce the basic theory and methodology behind these tools. First, it will present the potentiality of molecular modeling in the overall scenario from quantum to classical mechanics. Then, the basic principles and mathematical terms regulating the bonded and non-bonded forces among the atoms will be described

together with the methods used to solve the numerical problem. Finally, the course will provide a broad overview of the many different (both established and recent) simulation techniques including the reactive force field and some of the different coarse grain models, which allow to bridge the gap with the quantum mechanical scale and the continuum scale.

Short talks

B. V. BAZALIY

Mathematical models of a tumor growth

Institute of Applied Mathematics and Mechanics of NASU, Ukraine

bazaliy@iamm.ac.donetsk.ua

We consider the mathematical models of a tumor growth that contain free boundary problems for elliptic and parabolic equations.

T. BELIKOVA [1], V. SKOBTSOV [2], Yu. SKOBTSOV [3]

Evolutionary methods of ultrasonic medical images filtration

[1,2] *Institute of Applied Matematics and Mechanics of NASU, Ukraine*
[3] *Donetsk National Technical University, Ukraine*

[1]belikova.taisija@gmail.com, [2]vasko_vasko@mail.ru,
[3]ya_skobtsov@list.ru

It is considered the problem of filtration of ultrasound medical images using genetic algorithms. The set of filters and their optimal sequence is designed, which can improve image quality and detection of pathologies. As the training set used ultrasound images of the internal carotid artery at B-mode.

R. BERGMANN

The multivariate anisotropic wavelet transform on the torus

University of Lübeck, Germany

bergmann@math.uni-luebeck.de

Recently a framework for wavelets on the torus $\mathbb{T}^d \cong [-\pi, \pi)^d$ was developed to analyze multivariate periodic functions.

In this talk we present the patterns $\mathcal{P}(\mathbf{M})$, where $\mathbf{M} \in \mathbb{Z}^{d\times d}$ is an integer valued regular matrix, i.e. $m = |\det \mathbf{M}| > 0$. These

patterns are generalizations of the equidistant sets of points on $[0,1)$ and arise from the corresponding lattice $\Lambda(\mathbf{M}) := \mathbf{M}^{-1}\mathbb{Z}^d$.

The pattern is then used to define translation invariant spaces $V_{\mathbf{M}}^f \subset L_2(\mathbb{T}^d)$, which are characterized by using the Fourier series of a square integrable function $f : \mathbb{T}^d \to \mathbb{C}$ and a discrete Fourier transform with respect to $\mathbf{M}$ acting on $\mathcal{P}(\mathbf{M})$.

These characterizations lead to fast algorithms for the decomposition $V_{\mathbf{M}}^f$ into two orthogonal subspaces, that are both translation invariant with respect to a certain sub pattern of $\mathcal{P}(\mathbf{M})$.

Depending on f and the chosen decomposition, certain properties of a function sampled at the points of the pattern can be investigated.

F. CONSOLO [1], S. BRIZZOLA [2], F. ACOCELLA [3], V. GRIECO [4], G.B. FIORE [5], M. SONCINI [6]

Tissue engineering in urology: a biomechanical and histological characterization of a dynamically perfused acellular bladder matrix

[1,5,6] *Bioengineering Department, Politecnico di Milano, Italy*

[2,3,4] *Department of Veterinary Clinical Science, University of Milan, Italy*

[1]filippo.consolo@polimi.it, [2]stefano.brizzola@unimi.it, [3]fabio.acocella@unimi.it, [4]valeria.grieco@unimi.it, [5]gianfranco.fiore@polimi.it, [6]monica.soncini@biomed.polimi.it

A combined physical-chemical decellularization protocol for whole full-thickness bladder decellularization was developed through the application of repeated cyclic organ mechanical distention to facilitate the delivery of the decellularising agents within the inner layers of the tissue and the removal of cell debris. The dynamic perfusion was intended to reduce the tissue exposure time to the decellularising agents, thus limiting any adverse effects upon ECM ultrastructure. Inspection of the presence of residual DNA and RNA was carried out on decellularised matrices to verify effective cell removal and histological analysis was

combined with a comprehensive biomechanical characterization of the acellular tissue. In detail, histological investigation was focused on the assessment of the retention of adequate structural and functional components regulating biomechanical behaviour of the acellular tissue, while the biomechanical properties were evaluated at the mesoscale level through uniaxial tensile loading tests, and trough ex vivo filling cystometry to evaluate the whole organ mechanics in response to a physiological loading state.

W. ERB

Accelerated Landweber methods based on co-dilated orthogonal polynomials

University of Lübeck, Germany

erb@math.uni-luebeck.de

Well-known iterative schemes for the solution of ill-posed linear equations are the Landweber iteration, the cg-iteration and semi-iterative algorithms like the ν-methods. After introducing these methods, we show that for ill-posed problems a slight modification of the underlying three-term recurrence relation of the ν-methods provides accelerated Landweber algorithms with a better performance than the ν-methods. The new semi-iterative methods are based on the family of co-dilated ultraspherical polynomials. Compared to the standard ν-methods, the residual polynomials of the modified methods have a faster decay at the origin. This results in an earlier termination of the iteration if the spectrum of the involved operator is clustered around the origin. The asymptotic convergence rate of the modified methods turns out to be of the same order than the original ν-methods. At the end, the new semi-iterative methods are tested numerically in a parameter identification problem obtained from a model in elastography.

Yu. Yu. FEDCHUN [1], V. I. GERASIMENKO [2]

Towards derivation of evolution equations of hemokinetics

[1] *Taras Shevchenko National University of Kyiv, Ukraine*
[2] *Institute of Mathematics of NASU, Ukraine*

[1]fedchun.yu@ukr.net, [2]gerasym@imath.kiev.ua

We will discuss the fact that the evolution equations usually used in hemodynamics are not quite the same as those described the main features of blood flows. We suggest the microscopic model of a blood flow and justify the kinetic equations which can describe the typical macroscopic behavior of blood flows.

U. FORYŚ [1], M. BODNAR [2]

Generalized idea of Greenspan multicellular spheroid model for tumor growth

Faculty of Mathematics Informatics and Mechanics, Institute of Applied Mathematics and Mechanics, University of Warsaw, Poland

[1]urszula@mimuw.edu.pl, [2]mbodnar@mimuw.edu.pl

The idea of multicellular spheroids in tumor modeling comes from the papers of Greenspan. It is based on the assumption of spherical symmetry of tumor region. The tumor growths under the nutrient consumption and the supply of nutrient and oxygen is via diffusion. Simplification of the boundary and initial value problem for a reaction-diffusion model leads to a single ODE describing the tumor volume. In 3D case considered by Greenspan there appears the characteristic exponent 2/3 which expresses the ration between the tumor surface and volume. We use the same idea to propose the model in abstract n-dimensional case. It occurs that for 2D case of laboratory cellular colonies that model coincides with the well know logistic model. We include

time delay to the model and study the influence of the delay on the solution dynamics.

A. GAUTIERI

Multiscale modeling of biological and biomedical materials

Bioengineering Department, Politecninco di Milano, Italy

alfonso.gautieri@polimi.it

Atomistic simulations are computer simulation methods for investigating the motion of atoms and molecules. They can be viewed as a virtual microscope, which allow us to peer into the dynamic properties of proteins and materials in a way which is not possible in laboratory experiments. These techniques can be used to predict the physical properties (e.g., mechanics, transport properties) of biomolecules and biomaterials starting at fundamental -atomistic- level. This detailed knowledge, would help the understanding of the mechanisms underlying pathologic conditions as well as the development of new bio-inspired materials and thus presents an opportunity to institute a new paradigm of bioengineering at the interface of engineering and biology. The talk will cover the working principle of atomistic simulations and few applications.

A. GORIUNOV

Shin–Zettl quasi-differential operators and boundary problems

Institute of mathematics of NASU, Ukraine

goriunov@imath.kiev.ua

In this talk we deal with the Shin–Zettl quasi-differential operators of an arbitrary order in $L_2([a,b],\mathbb{C})$. The boundary triplets corresponding to minimal symmetric operator L are constructed.

These triplets are applied to describe all maximal dissipative, maximal accumulative and self-adjoint extensions of L and also all its generalized resolvents in terms of boundary conditions.

This theory is applied to singular Sturm–Liouville equations and two-term differential equations with distributional potential coefficients. The operators which correspond to such equations are interpreted as quasi-differential.

These results have been obtained together with V. Mikhailets.

Ya. I. GRUSHKA

Changeable sets and mathematical modeling of the evolution of systems

Institute of Mathematics of NASU, Ukraine
grushka@imath.kiev.ua

We study a new class of abstract mathematical objects — changeable sets. Changeable sets can be interpreted as a mathematical abstraction of the evolution models for physical, biological, and other systems in macrocosm.

From a formal point of view, changeable sets are sets of objects which, unlike the elements of ordinary (static) sets may be in the process of continuous transformations, and which may change properties depending on the point of view on them (the area of observation that is, actually, reference frame).

It should be noted, that the theory of changeable sets is not some "new set theory", ie for the construction of this theory it is not necessary to review or complement axiomatic foundations of classical set theory. Changeable sets are defined as a new abstract universal class of objects within the framework of classical set theory (just as are defined groups, rings, fields, lattices, linear spaces, etc.).

Subjects of the report is closely connected with the famous sixth Hilbert problem.

D. HENKEL

Optimal pointwise approximation of a stochastic evolution equation with additive noise

Universität zu Lübeck, Germany

henkel@math.uni-luebeck.de

We consider a stochastic evolution equation on the spatial domain $(0,1)^d$ with additive nuclear noise as well as additive space-time white noise, and we study approximation of the mild solution at a fixed time point. The error of an algorithm is defined by the average L_2-distance between the solution and its approximation, and the cost of an algorithm is defined by the total number of evaluations of one-dimensional components of the driving Brownian motion at arbitrary time nodes. We want to construct algorithms with an (asymptotically) optimal relation between error and cost, and we wish to determine the asymptotic behaviour of the corresponding minimal errors. This work was partially supported by the DFG.

V. KALMYKOV, T. ROMANENKO, V. VISHNEVSKEY

Spline approximation of the experimental data

Institute of Mathematical Machines and Systems, Ukraine

vl.kalmykov@gmail.com

Typically, the measured data represent a certain process, which is determined by the unknown function to be distorted by the noises. The analysis and the use of the data is considerably simplified if the data is represented as an analytic expression. The algorithm for processing the experimental data and an example of using this algorithm for spectrographic analysis of oncologic blood preparations is presented in this report.

A. I. KAZMERCHUK

Generalized bediagonal hyperbolic system of conservation laws

Prycarpatian National university by Vasyl Stefanyk, Ukraine

_kaz@rambler.ru

We study a class of hyperbolic systems of conservation laws of first order. We consider some properties of solutions, depending on parameters. Conditions of existence and uniqueness of solution of the Cauchy problem was obtained.

T. S. KRASNOPOLSKAYA [1], E. D. PECHUK [2]

Reconstruction of dynamical system from synthetic electrocardiogram (ECG) signal

Institute of Hydromechanics of NASU, Ukraine

[1]t.krasnopolskaya@tue.nl, [2]uzuzun@i.ua

The problem of construction of the deterministic dynamical system of human heartbeats from output electrocardiogram (ECG) signals is very important. Two reconstruction methods have been used and compared. First one is the method of successive differentiation and the second is based on delay coordinates. It was firstly suggested to choose time delay parameter from the stable region of a divergence of the reconstructed system. Results show that both methods can capture regular and chaotic signals from reconstructed systems of the third order with nonlinear terms up to sixth order. Types of signals were examined with spectral methods, construction of phase portraits and Lyapunov exponents. The method with delay coordinates was used for reconstruction a system from a synthetic electrocardiogram signal. The system of eighth order was built and analyzed. Temporal realizations and their power spectrums for the synthetic electrocardiogram and the first coordinate of the solution of

the reconstructed system are compared and studied. Temporal realizations have the equal period and similar behaviour. Power spectrums show the same components but the power spectrum of synthetic electrocardiogram is much wider.

G. V. KRIUKOVA

On network extreme eigenvalue

LMMNP, National Scientific Centre for Medical and Biotechnical Research of NASU, Ukraine
galyna.kriukova@gmail.com

We study network of populations of coupled phase oscillators with identical frequencies. We discuss dependency of critical coupling on the largest eigenvalue of the adjacency matrix describing the network connectivity. Network topologies with minimal largest eigenvalue are studied. We find that these systems can exhibit stable chimeras. Numerical experiments on simulated networks are used to test our results.

A. G. KYSELOVA

Context-aware energy efficient control system

National Technical University of Ukraine„Kyiv Polytechnic Institute“, Ukraine
a.g.kyselova@gmail.com

Context-aware energy efficient control system is positioned to provide efficient control of electric energy consumption with cost minimization. It consists of a raw context data preparing module, ontology module, and Context Prediction reasoning Module. The raw context data preparing module consist of algorithms that smoothed data. Ontology represents a description of the concepts and relationships. Context Prediction reasoning Module: it reasons out the context, interpreting context information using methods of pattern matching and predictions. All methods and algorithms that were described have been tested.

O. KYSELOVA [1], Ie. NASTENKO [2]

Quantitative estimates of heart rate regularities as a reflection of circulatory system regulatory redundancy

[1,2] *National Technical University of Ukraine „Kyiv Polytechnic Institute“, Ukraine,*
[2] *National M. Amosov' Institute of Cardio-Vascular Surgery*
[1]olga.mmif@gmail.com, [2]nastenko@inbox.ru

The main goal of the research is increasing the informativeness of heart rate (HR) monitoring data for prediction of cardiac pathologies.

The approach is applied to 24 h Holter recording of heart period variability obtained from 14 patients with normal state of cardio-vascular system and 18 patients with such pathologies as ischemic heart dilatation with circulatory deficiency, paroxysmal tachycardia, subaortic stenosis with circulatory deficiency. The time series were divided into sub-sequences with 1000 RR duration and processed for each interval during day and night time and transition periods.

The logistic map, fractal dimension, approximate entropy, sample entropy, permutation entropy, multiscale entropy and Kolmogorov algorithmic complexity parameters were calculated.

The statistical comparison of pointed parameters at different pathologies was done. The most suitable of them to identify pathologies were found. The coordinate space complexity-variability was used for study of peculiarities of HR dynamics.

A. M. LEOPALDI [1], R. VISMARA [2], L. VALERIO [3], M. LEMMA [4], C. ANTONA [5], G. GELPI [6], A. MANGINI [7], A. REDAELLI [8], G. B. FIORE [9]

A novel *in vitro* passive beating heart platform for research, device testing and training

[1,2,5,6,9] *Bioengineering Department, Politecnico di Milano, Milan, Italy*
[4,5,6,7] *Cardiovascular Surgery Department, "Luigi Sacco" University General Hospital, Milano, Italy*

[1,2,3,4,5,7,8,9] *ForCardio.Lab, Università di Milano, Politecnico di Milano, Milano, Italy*

[1]alberto.leopaldi@mail.polimi.it, [2]riccardo.vismara@polimi.it, [3]lorenzo.valerio@mail.polimi.it, [4]lemma.massimo@hsacco.it, [5]antona.carlo@hsacco.it, [6]gelpi.guido @hsacco.it, [7]mangini.andrea@hsacco.it, [8]alberto.redaelli@polimi.it, [9]gianfranco.fiore@polimi.it

New surgical techniques for heart valve repair, as well as the development of new cardiovascular devices, can be effectively supported by *in vitro* testing. A mock loop able to house an entire explanted porcine heart and subject it to pulsatile fluid-dynamic conditions was developed, in order to get real-time images of the valvular structures and to allow the performance of simulated surgical procedures. The proposed *in vitro* system was able to reproduce physiologic-like hemodynamic conditions in a reliable and cost-effective way, thus representing a promising tool for an accurate hemodynamic analysis of surgical valve repair procedures and minimally invasive cardiovascular devices, as well as for the training of clinicians.

V. N. LOS

Parabolic problems in a refined Sobolev scale

Chernigiv State Technological University, Ukraine

v_los@yahoo.com

We discuss some applications of Hilbert function spaces of generalized smoothness to parabolic PDEs. We show that the operator corresponding to a parabolic problem with the homogeneous Cauchy datum establishes a homeomorphism between appropriate anisotropic Hörmander spaces. They are parametrized with a real number and a positive radial function that varies slowly at infinity in the Karamata sense. These spaces form a refined Sobolev scale suitable for the theory of parabolic PDEs. Some applications of the homeomorphism are considered.

U. B. LUSHCHYK [1], V. V. NOVYTSKYY [2]

A mathematical modelling of processes in human organism

[1] *National Technical University of Ukraine „Kyiv Polytechnic Institute“, Ukraine*

[2] *Institute of Mathematics of NASU, Ukraine*

[1] u.lushchyk@gmail.com, [2] novyc@imath.kiev.ua

The human organism is a complex many-sided living system with numerous changeable parameters of its functioning on different levels of its organization with many indication systems and feedback connection. The present level of mathematical modeling development enables to investigate profoundly the hierarchy of the models functioning of the hybrid systems and study new unexplored algorithms of autoregulation in the living organism.

S. V. MASIUK [1], S. V. SHKLYAR [2], A. G. KUKUSH [3]

Estimation of radiation risk in the presence of measurement errors in exposure doses

[1] *Ukrainian Radiation Protection Institute, Ukraine,*

[2,3] *Taras Shevchenko National University of Kyiv, Ukraine*

[1] masja1979@gmail.com, [2] shklyar@univ.kiev.ua,

[3] alexander_kukush@univ.kiev.ua

Already in 5-6 years after the Chornobyl accident the inflation of thyroid cancer cases was observed for children and adolescents who lived at the territories where the estimated thyroid exposure doses were quite high. But interpretation of results for the most of thyroid radio-epidemiological studies, was based on risk estimation methods which do not take into account the presence of significant uncertainties in doses. One of the consequences of the assumption about the absence of errors in doses can be that the risk estimates are biased and the curve "dose - effect" is distorted. The aim of present work is to study radiation risk estimates and methods of risk estimation in models with additive measurement errors in exposure doses.

V. A. MIKHAILETS

Interpolation with function parameter of abstract and function Hilbert spaces

Institute of Mathematics of NASU, Ukraine

mikhailets@imath.kiev.ua

We discuss some applications of interpolation with function parameter of abstract Hilbert spaces to Sobolev and Hörmander function spaces. We explicitly describe all Hilbert spaces that are interpolation spaces with respect to a given couple of Sobolev inner product spaces considered over $\mathbb{R}^n$ or a bounded Euclidean domain with smooth boundary. These interpolation spaces form a subclass of isotropic Hörmander spaces. They are parametrized with a radial function parameter which is RO-varying at $+\infty$ as a function of $|\xi|$. An analogue of this description is obtained for Sobolev spaces given over a closed smooth manifold. The corresponding class of Hörmander spaces over the manifold is introduced and investigated.

O. O. MURACH

Refined Sobolev scale and elliptic problems

Institute of Mathematics of NASU, Ukraine

murach@imath.kiev.ua

The talk outlines recent results on elliptic problems in Hilbert function spaces of generalized smoothness. The latter are Hörmander spaces parametrized with a real number and a positive radial function varying slowly at $+\infty$ in the Karamata sense as a function of $|\xi|$. These spaces form the refined Sobolev scale. We discuss various theorems about the solvability of elliptic boundary-value problems on this scale and about the refined regularity of their solutions. New sufficient conditions for the solutions to have continuous derivatives are given. Some applications to the spectral theory of elliptic operators are considered.

Ie. NASTENKO

Actual tasks of hemodynamics investigation in human circulatory system

National Technical University of Ukraine „Kyiv Polytechnic Institute“, Ukraine,
National M. Amosov' Institute of Cardio-Vascular Surgery, Ukraine
nastenko@inbox.ru

The some problems of collecting and processing of empiric data will be considered. Some results of methods of cluster analysis application will be demonstrated.

The spiral contraction of left ventricle, and spiral flow in aorta, active behavior of muscular arteries and approaches for their modeling and simulation will be analyzed.

Cellular automaton model of capillary system and some regulatory characteristics obtained with it will be shown. The method of diagnostics of microcirculatory system state will be discussed.

P. OCCHETTA [1], F. PIRAINO [2], N. SADR [3], A. REDAELLI [4], M. MORETTI [5], M. RASPONI [6]

Microscale approaches to replicate in vitro the 3D cellular environment

[1,2,4,6] *Bioengineering Department, Politecnico di Milano, Italy*
[3,5] *Cell and Tissue Engineering Lab, IRCCS Istituto Ortopedico Galeazzi, Milano, Italy*
[1]paola.occhetta@mail.polimi.it, [2]francesco.piraino@polimi.it, [3]nasser.sadr@ccfm.it, [4]alberto.redaelli@ccfm.it, [5]matteo.moretti@polimi.it, [5]marco.rasponi@polimi.it

Native tissues are composed of functional three dimensional (3D) units on the scale of 100-1000μm. The 3D architecture of these repeating units underlies the coordination of multicellular processes such as proliferation, differentiation, migration and apoptosis. The requirement for 3D biomimetic matrices to mimic *in vitro* the ECM microarchitecture found *in vivo*

becomes relevant in complex and vascularized tissue engineered models. Among others, photopolymerizable hydrogels offer tunable mechanical features similar to the macromolecular-based components of soft ECM, can be crosslinked in the presence of a photoinitiator agent (PI) using visible or ultraviolet (UV) light irradiation, and have shown good compatibility with several protocols for cell embedding at different size-scales. A novel approach to generate 3D cell-laden micropatterns with highly controlled geometrical features has currently been investigated, based on the combination of polydimethylsiloxane (PDMS) replica molding and UVA photopolymerization of methacrylate hydrogels.

C. PAULICK

Decomposition of 3-way arrays: a comparison of different PARAFAC algorithms

Institute of Mathematics, Graduate School for Computing in Medicine and Life Sciences, University of Lübeck, Germany

paulick@math.uni-luebeck.de

Multidimensional decomposition techniques are common in many fields of application. The model of parallel factor analysis (PARAFAC), also known as canonical decomposition (CANDECOMP), is one of them. In this talk, five different algorithms of PARAFAC will be considered and their advantages and disadvantages examined.

A. PELOSI [1], G. B. FIORE [2], A. REDAELLI [3]

Design optimization of blood recirculating devices through computational fluid dynamics

Politecnico di Milano, Italy

[1]alessandra.pelosi@mail.polimi.it, [2]gianfranco.fiore@polimi.it, [3]alberto.redaelli@polimi.it

The talk will provide an overview on the design and optimization of blood recirculating devices using computational

fluid dynamics. A particular focus will be given to devices for extra-corporeal circulation; their main requirements will be highlighted, with particular relevance to the assessment of their thrombogenic potential. The events leading to platelet activation and thrombogenesis will be described, together with a model of blood damage. These concepts will be finally applied to the study of a prototypal blood oxygenator with integrated heat exchanger.

S. PENKA

Multivariate frequency detection

University of Lübeck, Germany

penka@math.uni-luebeck.de

We consider the problem of detecting periodicities in multivariate exponential sums from sampled values. For this purpose we extend a method for the one dimensional case, which uses orthogonal polynomials on the unit circle.

M. PIOLA [1], M. SONCINI [2], F. PRANDI [3], M. PESCE [4], G. B. FIORE [5]

Early arterialization phenomena in human saphenous bypass grafts studied ex vivo

[1,2,5] *Bioengineering Department, Politecnico di Milano, Italy*

[3,4] *Vascular Biology and Regenerative Medicine Laboratory, Centro Cardiologico Monzino, Italy*

[1]marco.piola@mail.polimi.it, [2]monica.soncini@polimi.it, [3]francesca.prandi@ccfm.it, [4]maurizio.pesce@ccfm.it, [5]gianfranco.fiore@polimi.it

Saphenous vein (SV) is the gold standard to revascularize the ischemic myocardium in coronary artery bypass graft (CABG) surgery. Long-term patency of SV, however, decreases over time after CABG, and 50% of SV bypasses undergo structural

modification due to development of intima hyperplasia, which ultimately leads to the occlusion of the graft lumen. In this scenario, we developed an ex-vivo vessel culture system (eVCS), aimed at elucidating the phenomena responsible for in vivo early arterialization of SV after CABG surgery, within a controlled and strictly reproducible mechanical environment. The design and manufacturing of the eVCS is presented, along with preliminary results concerning the early response of human SV segments to arterial pulsed pressure conditions ex vivo.

M. J. PIOTROWSKA [1], S. D. ANGUS [2]

A cellular automaton model of multicellular spheroids under irradiation

[1] *University of Warsaw, Faculty of Mathematics Informatics and Mechanics, Institute of Applied Mathematics and Mechanics, Poland*
[2] *Monash University, Department of Economics, Australia*

[1]monika@mimuw.edu.pl, [2]simon.angus@monash.edu

We present a quasi two dimensional Cellular Automaton (CA) model describing the dynamics of the *in vitro* cultivated multicellular spheroid obtained from EMT6/Ro (mammary carcinoma) cell line. By full calibration and scaling to available experimental data, the model produces with good accuracy experimentally comparable data on a range of bulk tumour kinetics and necrosis measures. Next, we extend our model by adding a cellular cycle module together with an irradiation and repair module. Significantly, our approach is not based on the Linear Quadratic model, instead, we propose a simple two parameter, algorithmic model which captures the essential biological features of irradiation-induced cell death, repair and associated cell cycle delays. Again, we present the calibration of this extended model both with, and without, the application of single irradiation doses to EMT6/Ro cell line.

A. V. POPOV

Asymptotic expansions of the eigenelements of Dirichlet spectral problem in thin perforated domains with rapidly varying thickness and different limit dimensions

Taras Shevchenko National University of Kyiv, Ukraine

popov256@gmail.com

A spectral Dirichlet problem is considered for the second-order symmetric elliptic differential operator with quickly oscillating coefficients in a thin perforated domain with different limit dimensions. The homogenized theorem is proved. Complete asymptotic expansions for the eigenvalues and eigenfunctions are constructed and justified under certain symmetry conditions for thin perforated domains and the coefficients of differential operators. The statement of problem originated from models of mathematical biology and was impelled by some questions arising in the theory of cell biology.

M. RASPONI [1], F. PIRAINO [2], G.B. FIORE [3], A. REDAELLI [4]

Microfluidics for cell culture applications

Bioengineering Department, Politecnico di Milano, Italy

[1]marco.rasponi@polimi.it, [2]francesco.piraino@polimi.it,
[3]gianfranco.fiore@polimi.it, [4]alberto.redaelli@polimi.it

Microfluidics refers to the devices, systems, and methods for the manipulation of fluid flows with characteristic length scales in the micrometer range. Microfluidic devices are especially suitable for biological applications, particularly on the cellular level, because the scale of channels corresponds with that of cells and the scale of the devices allows important factors to accumulate locally, forming a stable microenvironment for cell cultures. Compared with traditional culture tools, microfluidic platforms provide greater control over the cell microenvironment and a rapid optimization of media composition using relatively small numbers of cells. Microfluidic technology can

be used to supply and transfer media, buffers, and even gases while the waste products by cellular activities are drained in a way resembling the human circulatory system. Therefore, microfluidic systems can provide an in vivo-like environment for a cell culture as well as a reaction environment for a cell-based assay.

A. RÖSSLER

Numerical methods for stochastic models in life sciences

Universität zu Lübeck, Germany

roessler@math.uni-luebeck.de

Stochastic differential equations and their numerical solutions are considered. Therefore, some efficient numerical approximation schemes are presented. Finally, numerical simulation results are given and some applications in life sciences are discussed.

D. Yu. SADOVYJ

Homogenization of boundary-value problems in two-level thick junctions consisting of thin discs with rounded or sharp edges

Taras Shevchenko National University of Kyiv, Ukraine

sadovyj@univ.kiev.ua

We consider boundary-value problem in a three-dimensional two-level thick junction Ω_ε of type 3:2:2 which consists of a cylinder and a large number $2N = \mathcal{O}(\varepsilon^{-1})$ of thin discs from two levels. The discs from each level have thickness of order $\mathcal{O}(\varepsilon)$ and are ε-periodically attached to the lateral surface of the cylinder. The thin discs from the first level have varying thickness, which tends to zero while reaching the edges polynomially with an exponent $\gamma + 1$ (the parameter $\gamma > -1$), and the thin discs from the second level have constant thickness.

We study the influence of the parameter γ on the asymptotic behavior of solution to elliptic problem in Ω_ε as $\varepsilon \to 0$ and

establish three qualitatively different cases: $\gamma \in (-1, 0)$ (the thin discs have rounded edges), $\gamma = 0$ (linear edges), and $\gamma > 0$ (sharp edges). The results are obtained jointly with T. A. Mel'nyk.

M. Yu. SAVKINA

Mathematical background of the cytogenetical method of diagnosis of cancer of mammary gland

Institute of Mathematics of NASU, Ukraine
marta@imath.kiev.ua

The methods of the statistical and geometrical theory of pattern recognition are applied for detecting malignant tissue in the mammary gland and for differenting the diagnosis of breast cancer from fibroadenoma.

With the help of the $p-$statistic we calculate distances (measures of proximity) between the index of the scanograms of the examined patient and the corresponding indices of patients who are suffering from breast cancer and the indices of patients having the fibroadenoma.

These proximity measures permit us to obtain algorithms and test for recognition of the differetial diagnosis for breast cancer and fibroadenomatosis.

E. V. SEMENOVA

About optimal accuracy by fully discrete methods for solving Symm's equation in aposteriori case

Institute of Mathematics of NASU, Ukraine
lebedeva@ipnet.kiev.ua

For solving weakly singular Simm's equation we propose a fully discrete trigonometric collocation method and a fully discrete projection method with combination of balancing principle for choosing of an appropriate discretization parameter in aposteriori case. It is proved that such approach allows to obtain the optimal accuracy of the both methods for the case of perturbed input data in the metric of Sobolev spaces.

O. A. SIVAK

Asymptotic approximations for solutions to elliptic problems with different perturbed boundary conditions in perforated domains

Swansea University, UK

o.a.sivak@gmail.com

We consider quasilinear and linear boundary-value problems for the second order elliptic differential operator with rapidly oscillating coefficients in a domain Ω_ε that is ε-periodically perforated by small holes of order $\mathcal{O}(\varepsilon)$. The holes are divided into three ε-periodical sets depending on the boundary interaction at their surfaces. On the boundaries of holes from one set we have the homogeneous Dirichlet conditions. On the boundaries of the others, inhomogeneous Neumann and nonlinear Robin boundary conditions involving additional perturbation parameters are imposed. For the solution to the quasilinear problem we find the leading terms of the asymptotics and prove the corresponding asymptotic estimates that show influence of the perturbation parameters. In the linear case we construct and justify the complete asymptotic expansion for the solution using two-scale asymptotic expansion method.

The results were obtained jointly with T. A. Mel'nyk.

Y. A. SKOBTSOV [1], Y. V. RODIN [2], V. S. OVERKO [3]

Simulation and visualization of the flow of blood in the humans vessels with pathologies

[1,3]*Donetsk National Technical University, Ukraine*

[2] *Institute of Regeneration and Emergency Surgery, Donetsk, Ukraine*

[1]ya_skobtsov@list.ru, [2]rodin_vask@bk.ru, [3]overko.vitalij@yandex.ru

In this article we conducted a study of the hydrodynamics of blood in pathologically changed vessels. In particular, have been investigated curved vessels, bifurcation of vessels and vessels with atherosclerosis plaques. It was visualized the formation

of separated flows and determined pressures resistance in the abnormal areas of the blood vessels.

A. A. SOROKINA

Numerical investigation of erythroleukemia under spatial and temporal inhomogeneity

Southern Federal University, Rostov-on-Don, Russian Federation

sorokinaanna@nm.ru

The numerical method of erythroleukemia under spatial and temporal inhomogeneity is described in case of periodical cell flux. The numerical outline for two parabolic equations under one spatial variable is presented in terms of finite difference method. Some results of computing experiment are given.

T. M. SØRENSEN

Superconductors and magnetoencephalography

Centre of Mathematics for Applications, University of Oslo, Norway

t.m.sorensen@mn.uio.no

Magnetoencephalography (MEG) uses superconductors to enable exterior measurements of the extremely weak magnetic fields generated by the electric currents in the brain. We discuss the basic physics of MEG, as well as the mathematical inverse problem of inferring information about the interior electric currents from the measured exterior magnetic fields.

M. STEVANELLA [1], E. VOTTA [2], A. REDAELLI [3]

MRI-based left ventricle modelling for the prediction of ventricular function after revascularization

Politecnico di Milano, Italy

[1]marco.stevanella@mail.polimi.it, [2]emiliano.votta@polimi.it,
[3]alberto.redaelli@polimi.it

The appropriate choice of treatment to relieve ischemia and

restore effective left ventricular (LV) function in patients is challenging to the clinician. In this regard, clinical imaging techniques can provide relevant insight into regional and global LV function, as well as into myocardial viability.

The present talk will describe a computational platform for the assessment of LV function from cardiac magnetic resonance (CMR) imaging and the prediction of post-operative LV performance after myocardial revascularization therapy. Quantitative analysis of global and regional LV function in ischemic patients are performed through an algorithm semi-automated detection of endocardial and epicardial contours from short-axis CMR images, and integrated with information on myocardial viability derived from contrast-enhanced magnetic resonance imaging. These data are subsequently used as input for a predictive algorithm, designed for an easy and fast simulation of LV reverse remodeling after myocardial revascularization. Validation of algorithm predictions is performed with respect to MRI measurements at 6-month follow-up.

A. N. TIMOKHA

Dynamic processes in cells and human body associated with sloshing

Institute of Mathematics of NASU, Ukraine

tim@imath.kiev.ua

Forced free-surface motions of an encapsulated bio-liquid, e.g. cellular, inner ear, and eye response to external vibrations, liquid-structure coupling in circulatory system, possess equivalent mechanical analogies coming from spacecraft and marine applications that have been extensively studied from 60's. Presenting illustrative examples should help understanding how to employ these analogies in bio-mathematical modeling.

A. M. UNAKAFOV

Permutation entropy of mixing Markov shifts

Institute of Mathematics, Graduate School for Computing in Medicine and Life Sciences, University of Lübeck, Germany
anton@math.uni-luebeck.de

Markov shifts provide a special ordinal description of the Kolmogorov-Sinai entropy, simpler than the general one. On this base we show, how the permutation entropy of mixing Markov shifts is related to the Kolmogorov-Sinai entropy.

V. A. UNAKAFOVA

The relationship of permutation entropy and Kolmogorov-Sinai entropy

Institute of Mathematics, Graduate School for Computing in Medicine and Life Sciences, University of Lübeck, Germany
unakafova@math.uni-luebeck.de

The concept of permutation entropy has interesting applications and is well-justified theoretically. However, the question of the relationship between the permutation entropy and the Kolmogorov-Sinai entropy remains open in the general case. We discuss some ideas towards coincidence of these entropies.

L. VALERIO [1], R. VISMARA [2], C. ANTONA [3], A. MANGINI [4], M. CONTINO [5], A. REDAELLI [6], G. B. FIORE [7]

In vitro study of aortic valves treated with neo-chordae grafts: hydrodynamics and tensile force measurements

[1,2,6,7] *Bioengineering Department, Politecnico di Milano, Milan, Italy*
[1,2,3,4,5,6,7] *FoRCardioLab, Fondazione per la Ricerca in Cardiochirurgia ONLUS, Milan, Italy*
[3,4,5] *Cardiac Surgery Unit, H.L. Sacco, Universita‘ di Milano, Milan, Italy*
[1]lorenzo.valerio@mail.polimi.it

Reparative surgery of the aortic root functional unit (ARFU)

allows for a better preservation of the functionality of the native structure compared to prosthesis implantation. Post-operative results are satisfactory, whereas mid- and long-term results are challenging, for example in terms of cusps prolapse recurrence. At the Cardiothoracic Surgery Unit of the Sacco Hospital, a new surgical technique aimed at the stabilization in time of the results of standard ARFU repair operations has been applied. This technique, inspired by the mitral neo-chordae (NC) implantation, consists of implanting an e-PTFE suture thread between the prolapsed cusp and the sinotubular junction. Aim of this study was to assess the influence of NC implantation on the ARFU functioning by evaluating with an owned pulsatile in vitro apparatus the force magnitude acting on the NC and the dynamic behavior of porcine ARFUs treated according to the operating-room procedures.

N. VASYLYEVA

On the two-phase free boundary problems for Laplace operator

Institute of Applied Mathematics and Mechanics of NASU, Ukraine
vasylyeva@iamm.ac.donetsk.ua

We study the classical solvability of the two-phase free boundary problems for the Laplace operator in the case of the nonregular initial data.

S. VESENTINI [1], A. GAUTIERI [2], A. MEZZANZANICA [3],
G. SALVADORE [4], A. SENESI [5]

Bridging the gap with GAGs: Molecular modeling of glycoproteins of the extracellular matrix

Bioengineering Department, Politecnico di Milano, Milan, Italy
[1]simone.vesentini@polimi.it, [2]alfonso.gautieri@polimi.it,
[3]andrea.mezzanzanica@mail.polimi.it, [4]gaia.salvadore@mail.polimi.it,
[5]anna.senesi@mail.polimi.it

In general, connective tissue consists of cells and an extra-

cellular matrix (ECM) that includes fibers, ground substance, and tissue fluid. Connective tissues, which define bodily shape, must respond quickly, robustly and reversibly to deformations caused by internal and external stresses. On a molecular scale, glycosaminoglycan (GAG) interfibrillar bridges in shape modules are postulated to take part in a sliding filament process, which converts local compressions into disseminated tensile strains. Atom by atom molecular mechanics modelling is used to investigate what happens in lower level biological architectures. The knowledge of the molecular behaviour is used to formulate models for observed physical properties, to corroborate the early suggestions of a mechanical function and to suggest how they shape the higher scale architectures.

R. VISMARA

In vitro study of the aortic valve

Bioengineering Department, Politecnico di Milano, Italy

riccardo.vismara@polimi.it

Cardiovascular pathologies are among the leading causes of mortality and morbidity in the world, and cardiovascular pathologies which involve the aortic valve are very diffuse. In the last decade reparative surgery, which has been conventionally applied to the mitral valve, has been applied to the aortic valve. The complexity of this surgery and the lack of standardization limits its spread, despite its advantages as compare to traditional prosthesis implantation (no lifelong-drug therapies, no need of reintervention). At ForCardioLab surgeons and bioengineers apply experimental methods to study the biomechanics of the aortic valve and to develop novel surgical approaches to valve pathologies, with the twofold goal of optimize the approach and to standardize it.

M. V. VOITOVICH

The Dirichlet problem for nonlinear fourth-order equations with strengthened coercivity and natural growth lower order terms

Institute of Applied Mathematics and Mechanics of NASU, Ukraine

voytovich@bk.ru

We consider the Dirichlet problem for nonlinear elliptic fourth-order equations with the principal part satisfying a strengthened coercivity condition. It is supposed that the lower order term of the equations admits the growth rates of derivatives of unknown function coinciding with the exponents of the corresponding energy space ("natural" growth condition).

In the talk we discuss the existence of bounded generalized solutions to the given problem.

E. VOTTA [1], M. STEVANELLA [2], A. REDAELLI [3]

Heart valve patient-specific numerical modeling for surgical planning

[1,2,3]*Politecnico di Milano, Italy*

[1]emiliano.votta@polimi.it, [2]marco.stevanella@mail.polimi.it,
[3]alberto.redaelli@polimi.it

A non-neglilgible part of the world population is affected by heart valve diseases requiring surgical intervention. The careful planning of the intervention is crucial to the final clinical outcome, and would greatly benefit from the availability of quantitative tools capable of predicting the biomechanical effects of different surgical options for a given clinical scenario.

To this aim, great efforts are being devoted to develop patient-specific finite element models of the heart valves directly from pre-operative clinical images, which can be used to simulate ex ante the surgical procedure.

An overview of the recent advances in this field developed at Politecnico di Milano will be provided. Particular emphasis will

be given to those limitations of our current approach that may be overcome by means of advanced mathematical tools.

I. A. ZHDANOV [1], V. N. GOVORUCHIN [2]

Steady state solution flow of an ideal incompressible fluid through a rectangular channel

[1,2] *Southern Federal University, Russian Federation*

[1] bugfixer@bk.ru

The calculations of vortex structures with one parameter in box area with constant inflow and outflow speed and different vorticity on inflow bound are performed using finite-difference method. The way of numerical explorations is described. The series of results are shown.

V. S. ZUBKOV

Hyperosmolarity of the tear film in dry eye syndrom

Mathematical Institute, University of Oxford, UK

vladimir.s.zubkov@gmail.com

The biophysical factors that dictate hyperosmolarity and the observed patterns of tear film break-up in dry eye are poorly understood and are difficult to interrogate experimentally, highlighting the need for mathematical and computational modelling in this field. We have examined a model incorporating the influence of polar lipids overlying an aqueous layer, while tracking the evolution of osmolarity. Our strategic objective was to identify factors which may influence the risk of developing or exacerbating dry eye as well as exploring how such factors differ between evaporative dry eye and aqueous tear deficient dry eye. In particular, we focus on the dynamics of the solute concentration for the duration of a single blink and interblink. Our mathematical model tracks the thickness of the aqueous layer, the concentration of the polar lipid, together with the concentration of the solute.

List of Participants

Antoniouk, Alexandra	antoniouk.a@gmail.com
Bazaliy, Boris	bazaliy@iamm.ac.donetsk.ua
Belikova, Taisija	belikova.taisija@gmail.com
Bergmann, Ronny	bergmann@math.uni-luebeck.de
Bjaalie, Jan	j.g.bjaalie@medisin.uio.no
Coello, Cristopher	christopher.coello@medisin.uio.no
Consolo, Filippo	filippo.consolo@polimi.it
Erb, Wolfgang	erb@math.uni-luebeck.de
Fiore, Gianfranco Beniamino	gianfranco.fiore@polimi.it
Foryś, Urszula	urszula@mimuw.edu.pl
Gautieri, Alfonso	alfonso.gautieri@polimi.it
Gerasimenko, Viktor	gerasym@imath.kiev.ua
Goriunov, Andrii	goriunov@imath.kiev.ua
Grushka, Yaroslav	grushka@imath.kiev.ua
Henkel, Daniel	henkel@math.uni-luebeck.de
Kalmykov, Vladimir	vl.kalmykov@gmail.com
Kazmerchuk, Anatoliy	_kaz@rambler.ru
Keller, Karsten	keller@math.uni-luebeck.de
Kosterin, Sergiy	kinet@biochem.kiev.ua
Krasnopolskaya, Tatyana	t.krasnopolskaya@tue.nl
Kriukova, Galyna	galyna.kriukova@gmail.com
Kukush, Alexander	alexander_kukush@univ.kiev.ua
Kyselova, Anna	a.g.kyselova@gmail.com
Kyselova, Olga	olga.mmif@gmail.com
Langemann, Dirk	d.langemann@tu-bs.de

Leergaard, Trygve	t.b.leergaard@medisin.uio.no
Leopaldi, Alberto Maria	alberto.leopaldi@mail.polimi.it
Los, Valerii	v_los@yahoo.com
Lushchyk, Ulyana	u.lushchyk@gmail.com
Maksymenko, Sergiy	maks@imath.kiev.ua
Masiuk, Sergii	masja1979@gmail.com
Mel'nyk, Taras	melnyk@imath.kiev.ua
Mikhailets, Vladimir	mikhailets@imath.kiev.ua
Murach, Aleksandr	murach@imath.kiev.ua
Nastenko, Ievgen	nastenko@inbox.ru
Nesterenko, Borys	model@imath.kiev.ua
Nesteruk, Igor	inesteruk@yahoo.com
Novotarskyi Mykhailo	novot@imath.kiev.ua
Novytskyy, Viktor	novyc@imath.kiev.ua
Occhetta, Paola	paola.occhetta@mail.polimi.it
Osipchuk, Tatiana	otm82@mail.ru
Overko, Vitaliy	overko.vitalij@yandex.ru
Paulick, Claudia	paulick@math.uni-luebeck.de
Pechuk, Evgeniy	uzuzun@i.ua
Pelosi, Alessandra	alessandra.pelosi@mail.polimi.it
Penka, Sebastian	penka@math.uni-luebeck.de
Pereverzev, Sergei	sergei.pereverzyev@oeaw.ac.at
Pilipenko, Andrey	apilip@imath.kiev.ua
Piotrowska, Monika Joanna	monika@mimuw.edu.pl
Popov, Andrey	popov256@gmail.com
Prestin, Jürgen	prestin@math.uni-luebeck.de
Quak, Ewald	ewald.quak@cs.ioc.ee
Rajevskaja, Irina	raemarina@rambler.ru

Rajevskaja, Marina	raemarina@rambler.ru
Rasponi, Marco	marco.rasponi@polimi.it
Redaelli, Alberto	alberto.redaelli@ccfm.it
Rößler, Andreas	roessler@math.uni-luebeck.de
Sadovij, Dmytro	sadovyj@univ.kiev.ua
Savkina, Marta	marta@imath.kiev.ua
Semenova Evgeniya	lebedeva@ipnet.kiev.ua
Sivak, Olena	o.a.sivak@gmail.com
Skobtsov, Vadim	vasko_vasko@mail.ru
Skobtsov, Yuriy	ya_skobtsov@list.ru
Sørensen, Torquil Macdonald	t.m.sorensen@mn.uio.no
Sorokina, Anna	sorokinaanna@nm.ru
Stevanella, Marco	marco.stevanella@mail.polimi.it
Storrosten, Erlend Briseid	erlenbs@gmail.com
Teteryatnik, Elena	helenochka78@gmail.com
Timokha, Alexander	tim@imath.kiev.ua
Unakafov, Anton	anton@math.uni-luebeck.de
Unakafova, Valentina	unakafova@math.uni-luebeck.de
Valerio, Lorenzo	lorenzo.valerio@mail.polimi.it
Vasylyeva, Nataliya	vasylyeva@iamm.ac.donetsk.ua
Vesentini, Simone	simone.vesentini@polimi.it
Vismara, Riccardo	riccardo.vismara@polimi.it
Voitovich, Michail	voytovich@bk.ru
Votta, Emiliano	emiliano.votta@polimi.it
Zhdanov, Ivan	bugfixer@bk.ru
Zubkov, Vladimir	vladimir.s.zubkov@gmail.com