

Institute of Applied Mathematics and Mechanics

Bio-mathematics

Statistics

Numerical Analysis

Nonlinear PDEs

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Applied Mathematics

- Real life problem (interdisciplinary research)
 - Mathematical model (or statistical models based on data)
 - Rigorous studies (theorems, new theoretical methods, proofs)
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- Numerical simulations (optimal algorithms, paralel computing)
 - Interpretation

Bio-mathematics

- Mathematics applied in biology, medicine and social sciences
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- Modelling of tumor growth and anti-tumor therapy, immune system-tumor interaction, radiotherapy (M. Bodnar, U. Foryś, M. Lachowicz, M.J. Piotrowska)
 - Epidemiological models (U. Foryś, M.J. Piotrowska, A. Puchalska)
 - Modelling of brain processes (U. Foryś, J. Karbowski)
 - Mathematical models of quasicrystals (J. Miękisz)
 - Models in social sciences, the dynamics of opinions (M. Bodnar, U. Foryś, M. Lachowicz, T. Płatkowski, M.J. Piotrowska)
 - Game theory; dynamic games with continuum of players (A. Wiszniewska-Matyszkiewicz, T. Płatkowski, J. Miękisz)
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- Differential-integral equations, singular perturbation methods and relationships between microscopic and macroscopic description (M. Lachowicz).

Dynamical systems with random disturbances and time delays (M. Bodnar, U. Foryś, M. Piotrowska, J. Miękisz).

Statistics

- Modern mathematical statistics – theory and applications
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- Economical modelling and prediction for high dimension data (P. Pokarowski)
 - Biostatistics and medical statistics; interpretable machine learning (P. Biecek)
 - Hidden Markov models (B. Miasojedow, W. Niemi)
 - Nonparametric Bayesian statistics (J. Noble, W. Niemi)
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- Bayesian statistics
- Monte Carlo computational methods
- Applications of statistics in biology and medicine
- Machine learning

Numerical Analysis

- Modern computational methods- theory and applications
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- Parallel algorithms for solving systems of PDEs; preconditioning, for large systems, domain decomposition, discontinuous Galerkin method (L. Marcinkowski, P. Krzyżanowski, K. Sakowski)
 - Computational Complexity to non-discrete problems; information-based complexity, curse of dimensionality (L. Plaskota, P. Siedlecki, H. Woźniakowski).
 - Computer graphics; geometric modeling and visualisation; CAD/CAM systems (P. Kiciak)
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- Theoretical analysis of computational problems and their implementation; approximation, numerical integration, scientific computing.

Nonlinear PDEs

Equations of mathematical physics

- **Nonlinear PDEs in fluid mechanics, population biology, calculus of variations**
- Fluid mechanics: in/compressible fluids (P.B. Mucha, T. Piasecki, A. Świerczewska-Gwiazda)
- Fluid mechanics: heat conduction, attractors (G. Łukaszewicz)
- Collective dynamics (P.B. Mucha, J. Peszek)
- Metric graphs: equations on graphs (P.B. Mucha, O.Puchalska)
- Renormalized solutions to elliptic and parabolic equations (A. Zatorska-Goldstein, A. Świerczewska-Gwiazda)
- Calculus of variations, minimal gradient problem, crystal evolution (A. Zatorska-Goldstein, P. Rybka)
- Measure-valued solutions to PDES (A. Zatorska-Goldstein, A. Świerczewska-Gwiazda. I Chlebicka, P. Rybka)
- Semilinear parabolic equations, Harnack-type inequalities, singular solutions (M. Sierżęga)
- PDEs in Orlicz-Musielak space setting (I. Chlebicka, A. Zatorska-Goldstein, A. Świerczewska-Gwiazda)
- Systems of quasilinear parabolic equations, chemotaxis , cross-diffusion; pattern formation, global/singular solutions , ecological models. (D. Wrzosek)
- **Navier-Stokes eq. Euler eq., Young measures, measure-valued solutions, regularity, Besov spaces, compactness methods, entropy, non/linear semigroups, direct methods of calculus of variations**

Journals

- Comm. in Nonlinear Sci. and Numerical Simulations
- Math. Models. Methods Appl. Sciences
- Physical. Rev. Letters, Automatica
- J. Machine Learning Research , Annals of Applied Probability
- J. J Computational and Graphical Statistics,
- Science of the Total Environment, BMC bioinformatics,
- Analytical Chemistry
- Numerische Mathematik
- SIAM journal on numerical analysis
- J. of Complexity
- BIT Numerical Mathematics
- Calc. Variations and PDE,
- Mathematische Annalen
- Archive for rational mechanics and analysis
- Comm. On pure and applied Mathematics
- J. Diff. Equations