

**10<sup>th</sup> International Conference on  
Numerical Methods and Applications  
NM&A'22  
SCIENTIFIC PROGRAM**

**Monday, August 22**

09:00 – 09:15 Opening

**Chairperson:** Ivan Dimov

09:15 – 10:00 P. Binev, A. Bonito, R. DeVore, G. Petrova (Plenary lecture)  
Optimal Learning of Solutions of PDEs

10:00 – 10:20 *Break*

**Chairperson:** Svetozar Margenov

10:20 – 10:55 B. Duan, R. Lazarov, J. Pasciak (Keynote lecture)  
Numerical Solution of Systems Involving Fractional Powers of SPD Matrices Based on Vabishchevich Approach

10:55 – 11:20 S. Filipov, I. Faragó, A. Avdzhieva  
Mathematical Modelling of Nonlinear Heat Conduction with Relaxing Boundary Conditions

11:20 – 11:45 D. Slavchev, S. Margenov  
On the Application of a Hierarchical Semi-Separable Compression Solver for Parabolic Fractional Diffusion Problems with Varying Time Steps

11:45 – 12:10 S. Harizanov, I. Georgiev  
Three-dimensional Supervised Image Processing

12:10 – 13:30 *Break*

***Special Session “Numerical Search and Optimization”***

**Chairperson:** Stanislav Harizanov

13:30 – 14:05 K. Penev (Keynote lecture)  
Demanded Scale for Modern Numerical Optimisation

14:05 – 14:30 S. Fidanova, K. Atanassov  
Ant Algorithm for GPS Surveying Problem with Fuzzy Pheromone Updating

14:30 – 14:55 D. Jovanovic, T. Davidovic, D. Urosevic, T. Jaksic Kruger, D. Ramljak  
VNS for Community Detection on Undirected Graph

14:55 – 15:20 V. Todorov, I. Dimov, R. Georgieva, T. Ostromsky  
An Optimized Stochastic Method Based on  $\Lambda\Pi\tau$  Sobol Quasirandom Sequences for the Fredholm Integral Equation

15:20 – 15:45 V. Traneva, P. Petrov and S. Tranev  
Intuitionistic Fuzzy Knapsack Problem through the Index Matrices Prism

15:45 – 16:10 A. Alihodzic, E. Tuba, M. Tuba  
Two-Stage Algorithm for Solving Vehicle Routing Problem with Time Window

16:10 – 16:30 *Break*

Chairperson: Stefka Dimova

16:30 – 16:55 G. Nikolov  
New Bounds for the Extreme Zeroes of Classical Orthogonal Polynomials

16:55 – 17:20 L. Milev, N. Naidenov  
An Inequality for Polynomials on the Standard Simplex

17:20 – 17:45 P. Rashkov  
Construction of Reduced Basis Approximations of the Solutions to a Non-linear Eco-Evolutionary Model

17:45 – 18:10 M. Krastanov, B. Stefanov  
On the Decision Making under Uncertainty

18:10- 18:45 ***Welcome drink***

### **Tuesday, August 23**

Chairperson: Raycho Lazarov

09:00 – 09:45 T. Bayleyegn, I. Faragó, Á. Havasi, Z. Zlatev (Plenary lecture)  
Richardson Extrapolation and its Variant

09:45 – 10:30 N. Kosturski, S. Margenov, Y. Vutov (Plenary lecture)  
Non-Overlapping Domain Decomposition Methods of Optimal Computational Complexity

10:30 – 10:50 *Break*

#### ***Special Session “Computational Biology”***

Chairperson: Istvan Faragó

10:50 – 11:25 M. Borisov, S. Markov (Keynote lecture)  
On the Numerical Simulation of Epidemiological Outbreak Data Involving Uncertainties in the Rate Parameters

11:25 – 11:50 R. Anguelov  
Topological Dynamic Consistency of Numerical Methods for Dynamical Models in Biosciences

11:50 – 12:15 P. Rashkov, B. Kooi  
Epidemiological Models for Vector-Borne Diseases with Multiple Variants

12:15 – 13:30 *Break*

#### ***Special Session “Computational Biology”***

Chairperson: Peter Rashkov

13:30 – 13:55 A. Pashov, Sh. Pashova, P. Petrov  
Graph Representation of Antibody Complexity

13:55 – 14:20 D. Savostyanov  
Tensor Product Approach to Solving Chemical Master Equation for Epidemiological Modelling

14:20 – 14:45 E. Lilkova, P. Petkov, N. Ilieva, L. Litov  
Blocking the Immunosuppressing Action of the ORF6 Protein of the SARS-CoV-2 Virus:  
Computational Assays

14:45 – 15:10 P. Petkov, E. Lilkova, L. Litov, N. Ilieva  
In Silico Studies on the Peptide-Membrane-Interaction Energetics

15:10 – 15:35 F. Sapundzhi, M. Lazarova, M. Popstoilov  
Protein Structure Alignment and RMSD Calculations

15:35 – 15:55 *Break*

*Chairperson:* Maria Datcheva

15:55 – 16:20 I. Hristov, R. Hristova, I. Puzynin, T. Puzynina, Z. Sharipov, Z. Tuxhliev  
A Database of High Precision Trivial Choreographies for the Planar Three-Body Problem

16:20 – 16:45 P. Koprinkova-Hristova, S. Nedelcheva  
Simulation Investigations of Pyramidal Cells Layer Effect on Conscious Visual Perception

16:45 – 17:10 A. Atanasov, M. Koleva, L. Vulkov  
Parameter Estimation Inspired by Temperature Measurements for a Chemotactic Model of Honeybee Thermoregulation

17:10 – 17:35 A. Atanasov, S. Georgiev, L. Vulkov  
Numerical Parameter Estimation in a Multiple Factor Model for Population Dynamics of Bee Colony

### **Wednesday, August 24**

#### ***Excursion & Conference Dinner***

### **Thursday, August 25**

*Chairperson:* Zahari Zlatev

09:00 – 09:45 L. Zikatanov, Y. Li (Plenary lecture)  
A Posteriori Error Estimates in Finite Element Method by Preconditioning

09:45 – 10:30 K.-A. Mardal (Plenary lecture)  
Why Do We Sleep? - Multi-Physics Problems Related to Brain Clearance

10:30 – 10:50 *Break*

#### ***Special Session “Large-Scale Models: Numerical Methods, Parallel Computations and Applications”***

*Chairperson:* Ludmil. Zikatanov

10:50 – 11:25 Z. Zlatev, I. Dimov, K. Georgiev (Keynote lecture)  
Performance of Advanced Air Pollution Studies by Using a Digital Twin

11:25 – 11:50 T. Ostromsky, V. Todorov, I. Dimov, R. Georgieva  
Sensitivity Analysis of an Air Pollution Model with Using Innovative Monte Carlo Methods in Calculating Multidimensional Integral

11:50 – 12:15 B. Pavlov, L. Litov, P. Petkov, N. Ilieva  
Machine Learning for Monitoring of Complex Detector Systems

12:15 – 13:30 *Break*

#### ***Special Session “Advanced Material Modelling and Simulations”***

*Chairperson:* Kent-Andre Mardal

13:30 – 14:05 J. Kaplunov (Keynote lecture)  
2D Asymptotic Models for Transversely Inhomogeneous Elastic Plates

14:05 – 14:30 R. Ivanov, S. Pshenichnov, M. Datcheva  
Finite Element Analysis of Wave Propagation in Viscoelastic Media

- 14:30 – 14:55 T. Zhelyazov, S. Pshenichnov  
Simulation of the Mechanical Wave Propagation in a Viscoelastic Media with and without Rigid Inclusion
- 14:55 – 15:20 L. Nguyen-Tuan, M. Müller, H.-M. Ludwig, T. Lahmer  
Simulation and Experimental Verification of Ultrasonic Wave Propagation in Imperfect Concrete Structures using XFEM
- 15:20 – 15:45 R. Iankov, A.V. Nasedkin, A.A. Nasedkina  
Numerical Analysis of Contact Interaction of Parabolic Stamp with Poroelastic Functionally Graded Layer Taking into Account Surface Stresses

15:45 – 16:05 *Break*

***Special Session “Advanced Material Modelling and Simulations”***

Chairperson: Julius Kaplunov

- 16:05-16:40 M.I. Chebakov, M. Datcheva, A.V. Nasedkin, A.A. Nasedkina (Keynote lecture)  
Analysis of Effective Properties of Poroelastic Composites with Surface Effects Depending on Boundary Conditions in Homogenization Problems
- 16:40 – 17:05 V. Vucheva, V. Vassilev, N. Kolkovska  
Numerical Solutions of the Boussinesq Equation with Nonlinear Restoring Force
- 17:05 – 17:30 P. Koprinkova-Hristova, I. Georgiev, S. Nikolova, D. Toneva  
Echo State Network for Features Extraction and Segmentation of Tomography Image
- 17:30 – 17:55 S. Filipov, F. Tomova  
Covering a Set of Points with a Minimum Number of Equal Circles via Simulated Annealing
- 17:55 – 18:20 R. Iankov, I. Georgiev, E. Kolosiva, M. Chebakov, M. Datcheva  
Evaluation of the Effective Material Properties of Media with Voids Based on Numerical Homogenization and Microstructure Testing Data

**Friday, August 26**

Chairperson: Roumen Iankov

- 09:00 – 09:25 F. Benkhaldoun, A. Bradj  
Convergence Analysis of a Finite Volume Scheme for a Distributed Order Diffusion Equation
- 09:25 – 09:50 F. Benkhaldoun, A. Bradji  
SUSHI for a Time Fractional Diffusion Equation with Delay
- 09:50 – 10:15 W. Aboussi, F. Benkhaldoun, A. Bradji  
SUSHI for a Bingham Flow Model

10:15 – 10:35 *Break*

Chairperson: Petia Koprinkova-Hristova

- 10:35 – 11:00 M. Konstantinov, N. Zlateva  
Epsilon Subdifferential Method And Integrability
- 11:00 – 11:25 M.-A. Mitran  
A Theoretical Analysis on the Bound Violation Probability in Differential Evolution Algorithm
- 11:25 – 11:50 M. Emin Gülsen, Ö. Yayla  
Random Sequences in Vehicle Routing Problem

- 11:50 – 12:15 J. Kandilarov, L. Vulkov  
A Finite Element Method for Reconstruction of Time-Dependent Convection Coefficient and Source  
in Magnetohydrodynamics System
- 12:15– 12:30 *Closing*

**The event will take place at Samokov hotel in Borovets and at the ZOOM platform**

**Topic: 10-th International Conference on Numerical Methods and Applications**

**Join Zoom Meeting:**

**<https://us02web.zoom.us/j/88080700481?pwd=U3k2NFU1MzViWFhMa2pHQVRueWRzQT09>**

**Meeting ID: 880 8070 0481**

**Passcode: 322217**