

INTERNATIONAL CONFERENCE ON
MATHEMATICAL MODELLING
AND COMPUTATIONAL METHODS
IN APPLIED SCIENCES AND ENGINEERING

Modelling 2019

Scientific programme

OLOMOUC, CZECH REPUBLIC

SEPTEMBER 16–20, 2019

September 16 – Monday

10:30 - 14:00 Registration

12:00 - 14:00 *Lunch*

14:00 - 14:45 Opening the conference
Medal for Owe Axelsson

Plenary lectures

Room: Codex-Script

Chairman: R. Blaheta

14:45 - 15:30 U. Růde: Parallel algorithms for solving finite element systems with a ten trillion unknowns

15:30 - 16:15 O. Ernst: Uncertainty quantification for PDE models

16:15 - 16:45 *Coffee break*

Plenary lectures

Room: Codex-Script

Chairman: T. Vejchodský

16:45 - 17:30 S. Repin: Reliable quantitative analysis of incompressible media problems

17:30 - 18:15 V. Průša: Thermodynamics of viscoelastic rate-type fluids and its implications for stability analysis

19:00 *Welcome reception*

September 17 – Tuesday

Plenary lectures

Room: Codex-Script

Chairman: V. Dolejší

09:00 - 09:45 P. Krejčí: Hysteresis modeling in piezoelectric and magnetostrictive materials

09:45 - 10:30 J. Schöberl: NGSolve - A framework for advanced finite element methods

10:30 - 11:00 *Coffee break*

Industrial workshop I

Room: Codex-Script

Chairman: D. Lukáš

11:00 - 11:30 I. Mikulčík, J. Kruis: Numerical analysis of thermoplastic tanks

11:30 - 12:00 O. Kolditz: Modeling of geosystems for energy applications

12:00 - 12:30 Y. Obara, T. Sono: DEM analysis of chipping of concrete by a pneumatic breaker and mechanism of its damage

12:30 - 12:50 T. Kozubek: About IT4Innovations and cooperation with industry

12:50 - 14:00 *Lunch*

September 17 – Tuesday

Parallel session A – **Industrial workshop II**

Room: Codex-Script

Chairman: M. Hokr

- 14:00 - 14:30 O. Zobal, T. Koudelka: Numerical analysis of coupled heat and moisture transfer in facades
- 14:30 - 15:00 E. Hrubešová, N. Rapantová: How to simulate hydro-mechanical behaviour of complex unstable slope?
- 15:00 - 15:20 J. Kruis: Numerical analysis of geotechnical stability based on coupled hydro-mechanical model of soil
- 15:20 - 15:40 G. Pierrot: On some mathematical challenges in industrial CFD

Parallel session B – **Minisymposium 6**

Room: Plato-Seneca

Chairman: V. Průša

- 14:00 - 14:20 J. Blechta: On PCD preconditioner for Navier-Stokes equations
- 14:20 - 14:40 P.A. Gazca-Orozco: Preconditioning systems arising from a 3-Field discretisation of incompressible non-Newtonian flow
- 14:40 - 15:00 M. Habera: Concrete ageing: computational and high-performance aspects
- 15:00 - 15:20 K. Tůma: Cubic to tetragonal martensitic transformation in NiAl shape memory alloy
- 15:40 - 16:10 *Coffee break*

September 17 – Tuesday

Parallel session A – Minisymposium 2 I

Room: Codex-Script

Chairman: S. Sysala

- 16:10 - 16:30 J. Haslinger: The parameter identification in the Stokes system with threshold slip boundary conditions
- 16:30 - 16:50 R. Kučera: Stokes problem with the stick-slip boundary condition in 3D
- 16:50 - 17:10 L. Baffico: Fluid-structure interaction problems with friction boundary condition on the interface
- 17:10 - 17:30 J. Machalová: The control variational method for nonlinear Gao beam
- 17:30 - 17:50 J. Burkotová: Optimal thickness distribution of stepped nonlinear Gao beam

Parallel session B – Minisymposium 4 I

Room: Plato-Seneca

Chairman: O. Ernst

- 16:10 - 16:30 J. Chleboun: A data-driven membership function in uncertainty quantification of a magnetostrictive energy harvester output
- 16:30 - 16:50 J. Franců: Homogenization of problems with uncertain hysteresis operators
- 16:50 - 17:10 M. Kubínová: New spectral bounds to preconditioned stochastic Galerkin systems
- 17:10 - 17:30 E. Vidličková: A posteriori error estimation for random time dependent PDEs
- 17:30 - 17:50 T.-V. Hoang: Non-deterministic parameter identification using Dempster's rule of combination on random set models
- 18:30 *Dinner*

September 18 – Wednesday

Parallel session A – **Industrial workshop III**

Room: Codex-Script

Chairman: T. Kozubek

- 09:00 - 09:20 T. Krátký: Numerical modelling applications in pump industry
- 09:20 - 09:40 J. Běhal: Weight reducing of track rod arm structure by using of several optimization approaches
- 09:40 - 10:00 M. Čermák: The methodology for material model identification and validation I
- 10:00 - 10:20 R. Halama: The methodology for material model identification and validation II

Parallel session B – **Minisymposium 1 I**

Room: Plato-Seneca

Chairman: Y. Saad

- 09:00 - 09:20 O. Axelsson: New applications of the PRESB preconditioning method
- 09:20 - 09:40 J. Karátson: Robust preconditioning methods using equivalent operators
- 09:40 - 10:00 J. Papež: From a posteriori algebraic error estimator to multilevel iterative solver with p -robust behavior
- 10:00 - 10:20 M. Neytcheva: Deflation techniques – advances, based on utilizing the Generalized Locally Toeplitz theory

Parallel session C – **Minisymposium 4 II**

Room: Marconi

Chairman: J. Chleboun

- 09:00 - 09:20 J. Březina: Multilevel Monte Carlo method for Darcy flow in fractured porous media
- 09:20 - 09:40 A. Kučerová: Bayesian inference in thermal tomography
- 09:40 - 10:00 J. Vondřejc: Bayesian parameter identification for highly nonlinear problems
- 10:00 - 10:20 J. Radová: Optimal control method for solution of nonlinear inverse problem
- 10:20 - 10:50 *Coffee break*

September 18 – Wednesday

Parallel session A – **Industrial workshop IV**

Room: Codex-Script

Chairman: J. Březina

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- 10:50 - 11:10 M. Kroupa, V. Zmuda: Practical aspects of coupled groundwater flow and contaminant transport modelling in the context of remediation after in situ leaching of uranium
- 11:10 - 11:30 M. Hokr: Flow and transport inverse modelling with parameterization of the fracture laser scan input data
- 11:30 - 11:50 S. Harizanov: Digital image processing of porous media via constrained convex optimization
- 11:50 - 12:10 M. Hasal: Modelling of THM processes for the design of the safe deep nuclear waste repository

Parallel session B – **Minisymposium 1 II**

Room: Plato-Seneca

Chairman: M. Neytcheva

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- 10:50 - 11:10 Y. Saad: Parallel Multilevel Low-Rank approximation preconditioners
- 11:10 - 11:30 S. Meggendorfer: Monolithic preconditioning of Biot's consolidation model
- 11:30 - 11:50 T. Luber: Single and double Schur complement preconditioners for the Biot systems
- 11:50 - 12:10 M. Tůma: Stretching for solving the linear least squares

Parallel session C – **Contributed talks I**

Room: Marconi

Chairman: Š. Papáček

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- 10:50 - 11:10 R. Company: Numerical solution of American option pricing problems under stochastic volatility
- 11:10 - 11:30 L. Jódar: Solving numerically random hyperbolic problems
- 11:30 - 11:50 R. Cimrman: Optimized pseudopotentials for electronic structure calculations
- 11:50 - 12:10 M. Bailová: A mountain pass algorithm for quasilinear boundary value problem with p-Laplacian
- 12:10 - 14:00 *Lunch*
Olomouc - city sightseeing
- 17:30 St. Moritz church - sight of famous organ and concert
- 19:00 *Gala dinner, Café Restaurant Caesar, Town Hall*

September 19 – Thursday

Parallel session A – Minisymposium 3 I

Room: Codex-Script

Chairman: P. Arbenz

- 09:00 - 09:20 J. Šístek: Parallel multilevel domain decomposition with adaptive mesh refinement
- 09:20 - 09:40 M. Hanek: Multilevel BDDC method for incompressible Navier-Stokes equations
- 09:40 - 10:00 D. Horák: Projector-avoiding highly scalable variant of TFETI for contact problems implemented in the PERMON toolbox
- 10:00 - 10:20 T. Brzobohatý: ESPRESO - highly parallel finite element package for engineering simulations

Parallel session B – Minisymposium 2 II

Room: Plato-Seneca

Chairman: S. Repin

- 09:00 - 09:20 D. Apushkinskaya: Some estimates for solutions of the thin obstacle problem
- 09:20 - 09:40 S. Nakov: Reliable solution of the Poisson-Boltzmann equation with application to the SecYEG membrane channel
- 09:40 - 10:00 T. Vejchodský: Rigorous and fully computable a posteriori error bounds for eigenfunctions
- 10:00 - 10:20 V. Dolejší: Space-time discontinuous Galerkin method for the numerical solution of degenerate parabolic equations
- 10:20 - 10:50 *Coffee break*

September 19 – Thursday

Parallel session A – Minisymposium 3 II

Room: Codex-Script

Chairman: J. Šístek

- 10:50 - 11:10 P. Arbenz: Solving large-scale interior eigenvalue problems to investigate the vibrational properties of the boson peak regime in amorphous materials
- 11:10 - 11:30 A. Basermann: Exascale sparse eigensolver developments for quantum physics applications
- 11:30 - 11:50 B. Lang: Efficient parallel reduction of bandwidth in direct eigensolvers
- 11:50 - 12:10 T. Cimic: Enlarged Krylov methods and 2-level preconditioner for the map-making problem in CMB data analysis
- 12:10 - 12:30 M. Zounon: Parallel linear algebra software reengineering for modern multicore architectures

Parallel session B – Minisymposium 2 III

Room: Plato-Seneca

Chairman: J. Haslinger

- 10:50 - 11:10 D. Reddy: Some perspectives on rate-independent strain-gradient plasticity
- 11:10 - 11:30 S. Sysala: Duality theory methods for limit load analysis in perfect plasticity
- 11:30 - 11:50 H. Netuka: Buckling solution for nonlinear Gao beam
- 11:50 - 12:10 P. Exner: Extended finite element method for approximation of groundwater flow singularities
- 12:10 - 12:30 A. Chorfi: A domain decomposition method for a bonded structure
- 12:30 - 14:00 *Lunch*

September 19 – Thursday

Parallel session A – **Minisymposium 5 I**

Room: Codex-Script

Chairman: J. Kraus

- 14:00 - 14:20 M. Lybery: Parameter-robust fixed-stress split iterative scheme for multiple-permeability poroelasticity
- 14:20 - 14:40 Ch. Lee: Nonlinear multigrid solvers for subsurface flow simulation using spectral coarsening
- 14:40 - 15:00 H. Egger: Structure preserving approximation of quasistatic poroelasticity
- 15:00 - 15:20 M. Bause: The Nitsche method for higher order Galerkin-collocation approximation in time of the Navier–Stokes equations
- 15:20 - 15:40 M. Béréš: Numerical methods for simulation of steady flow in fractured porous media with hydro-mechanical coupling

Parallel session B – **Contributed talks II**

Room: Plato-Seneca

Chairman: Z. Dostál

- 14:00 - 14:20 M. Feistauer: Discontinuous Galerkin method for the simulation of fluid-structure interaction with applications to vocal fold vibrations
- 14:20 - 14:40 S. Margenov: BURA method for fractional diffusion problems with Neumann boundary conditions
- 14:40 - 15:00 J. Duintjer Tebbens: Extending a pharmacodynamic model for nuclear receptor-induced enzyme production with spatial resolution
- 15:00 - 15:20 J. Pech: Spectral/hp element method in simulations of unsteady flows with heat transfer
- 15:20 - 15:40 B. Bastl: Multi-patch B-spline parameterizations of blade cascades and their influence to incompressible fluid flow simulations by isogeometric analysis
- 15:40 - 16:10 *Coffee break*

September 19 – Thursday

Parallel session A – **Minisymposium 5 II**

Room: Codex-Script

Chairman: M. Lymbery

- 16:10 - 16:30 A. Arrarás: Multipoint flux approximation methods for a double porosity Darcy-Forchheimer flow model in porous media
- 16:30 - 16:50 M. Dugstad: Upscaling of polymer EOR in fractured media
- 16:50 - 17:10 V. Lukeš: Computational homogenization of large deforming fluid-saturated porous structures
- 17:10 - 17:30 A. Chirilă: Wave propagation in diffusive microstretch thermoelasticity

Parallel session B – **Contributed talks III**

Room: Plato-Seneca

Chairman: R. Kučera

- 16:10 - 16:30 M. Mračko: Computational Time reversal: localization of cracks
- 16:30 - 16:50 D. Gabriel: Explicit bipenalty finite element contact-impact algorithm
- 16:50 - 17:10 R. Kolman: Inverse mass matrix for higher-order finite element method via localized Lagrange multipliers
- 17:10 - 17:30 A. Berezovski: Internal variables as a tool for microstructure influence modeling
- 17:30 - 17:50 D. Lukáš: A uniform parallel framework to large-scale simulations of 3d wave-type equations

September 19 – Thursday

Poster session

Room: Codex-Script

Chairman: M. Kubínová

18:00 - 18:30 Flash poster introduction (2 minutes per poster)

1. J. Arbelaez Gaviria: Numerical solution of water flow in porous medium under phase changes due evaporation
2. M. Bobková: The bending of a beam with obstacle and given friction
3. S. Domesová: Acceleration of posterior sampling using surrogate models
4. L. Foltyn: Parallel method for solving transient heat equation
5. J. Jablonský: Systems biology analysis of an *in vitro* xenobiotic metabolizing enzyme induction
6. M. Kuráž: Solving the erosion transport equation on three dimensional catchments
7. M. Ladecký: FFT-based homogenisation accelerated by low-rank approximations
8. M. Merta: A parallel space-time boundary element method for the heat equation
9. E. Straková: Piezo-acoustic FEM analysis
10. D. Ulčák: High-order BEM and Gauss-Christoffel quadrature

18:30 Discussion on posters

Reception

September 20 – Friday

Plenary lectures

Room: Codex-Script

Chairman: M. Tůma

09:00 - 09:45 Y. Saad: Numerical linear algebra for data-driven applications

09:45 - 10:30 D. Reddy: Convergent approximations for near-incompressible and near-inextensible transversely isotropic elasticity

10:30 - 11:00 *Coffee break*

Parallel session A – Minisymposium 5 III

Room: Codex-Script

Chairman: M. Feistauer

11:00 - 11:20 P. Krejčí: A model for phase transitions in deformable porous media

11:20 - 11:40 R. Vodák: Richard's equation and a semi-continuum model for fluid flow in porous medium

11:40 - 12:00 J. Kmec: A semi-continuum model to explain fluid flow

Parallel session B – Contributed talks IV

Room: Plato-Seneca

Chairman: D. Horák

11:00 - 11:20 B.K. Singh: Free-surface LBM simulation of droplet dynamics with the waLBerla multiphysics framework

11:20 - 11:40 Z. Dostál: Conditioning of large H-TFETI clusters and the scope of scalability

11:40 - 12:00 J. Vala: Exact solutions of a thick beam on Pasternak subsoil in finite element calculations

Closing the conference

12:00 - 14:00 *Lunch*