

Numerical methods and HPC for industrial applications

IFPEN, Rueil-Malmaison, 4-6 December 2019

Preliminary Program

Wednesday 4 December

- 08.30 Opening of the welcome desk
- 09.30 **Opening address**
S. Yousef, Scientific Correspondent of SimRace (IFPEN, France)
- Welcome address**
E. Heintzé, Scientific Director (IFPEN, France)

Session 1 - Theory and algorithms for parallel computation

- 09.45 **Keynote lecture by Ulrich Rüde** (Friedrich-Alexander-Univ. Erlangen-Nuremberg, Germany)
- 10.30 **Over-relaxation kinetic schemes: development of boundary conditions and MHD simulations**
F. Druil, Ph. Helluy (CEA, Univ. of Strasbourg, Inria, France)
- 10.55 **Application of an iterative Golub-Kahan algorithm to structural mechanics problems**
C. Kruse, M. Arioli, U. Rüde, M. Sosonkina, N. Tardieu (Cerfacs, France ; Libera Univ. Mediterranea, Italy ; FAU, Germany ; Old Dominion Univ. USA ; EDF-CNRS-CEA-ENSTA, Univ.Paris Saclay, France)
- 11.20 Break
- 11.40 **Introducing cell-based AMR in two-phase flow simulations: a modern open-source approach with canoP**
R. Di Battista, S. De Chaisemartin, S. Jay, M. Massot, P. Kestener (Ecole Polytechnique, IFPEN, CMAP-CNRS,CEA, Maison de la Simulation, France)
- 12.05 **2d and 3d remeshing: presentation of the Mmg library with several applications**
C. Dapogny, C. Dobrzynski, A. Froelhy, P.Frey (CNRS, InriaSoft, ISCD Sorbonne Univ., France)
- 12.30 **Alien: a Flexible Wrapper API on Linear Solvers**
C. Chevalier, S. Desroziers, J-M. Gratién, P. Havé, X. Tunc (CEA, IFPEN, Haveneer, France)
- 13.00 Lunch

Session 2 - Numerical methods and algorithms in science and engineering/1

- 14.30 **Keynote lecture by Alexandre Ern** (Univ. Paris-Est, CERMICS-ENPC & INRIA, France)
- 15.15 **Guaranteed and robust L2-norm a posteriori error estimates for 1D linear advection problems**
A. Ern, M. Vohralik, **M. Zakerzadeh** (Cermics-ENPC, Inria, France)

- 15.40 Convergence of an energy dissipative scheme for immiscible two-phase flows in anisotropic porous media
C. Cancès, **F. Nabet** (Inria, Univ. of Lille, CNRS, CMAP/Ecole Polytechnique, France)
- 16.05 On an efficient time scheme based on a new mathematical representation of thermodynamical equilibrium for multiphase compositional Darcy flows in porous media
J. Coatléven, C. Meiller (IFPEN, France)
- 16.30 Break
- 16.55 Adaptive Higher Order Methods for Porous Media and Non-Newtonian Fluid Flow Problems
B. Kane, R. Klöfken, A. Dedner, S. Tveit (Norwegian Research Centre AS, Norway ; Mathematics Institute/Univ. of Warwick, United Kingdom)
- 17.20 oHHO-DFN : a Hybrid High Order (HHO) method for the simulation of flow in large tridimensional Discrete Fracture Networks (DFN)
F. Hédin, G. Pichot, A. Ern (Inria, Ecole Ponts Paris-Tech, France)
- 17.45 Improving convergence of a non-linear algorithm for fracturing and cementing simulations
G.V. Ovchinnikov, S.A. Boronin, D.Yu. Derbyshev, A.A. Osipov, I.V. Oseledets (Skolkovo Institute of Science & Technology, Russia)
- 18.30 **Happy Hour, Café Leffe in Rueil-Malmaison**

Thursday 5 December

- 08.30 Opening of the welcome desk

Session 3 - HPC, data and AI

- 09.00 **Keynote lecture by Marc Schoenauer** (Inria, France)
- 09.45 Optimization of multigrid parameters with machine learning
A. Katrutsa, T. Daulbaev, I. Oseledets (Skolkovo Institute of Science & Technology, Russia)
- 10.10 Acceleration of a thermodynamic equilibrium simulator by machine learning
Th. Faney, J-Ch De Hemptinne, S. Yousef, IFPEN, France)
- 10.35 Break
- 11.50 Topology optimization of connections in mechanical systems
L. Rakotondrainibe, G. Allaire, P. Orval (Technocentre Renault, CMA Ecole Polytechnique, France)
- 11.15 Comparison of two hyper-reduction methods for cyclic elasto-viscoplastic computations
T. Daniel, D. Ryckelynck, F. Casenave, N. Akkari (SafranTech, Mines ParisTech, PSL Univ, CMAT, CNRS, France)
- 11.40 Data movement: toward an end-to-end Solution for AI Centered Workflow
J-Th Acquaviva, S. Martinek, R. Rehbürg (DDN Storage, France ; Altair, Germany)
- 12.05 Lunch

Session 4 - Numerical methods and algorithms in science and engineering – 2

- 13.30 **Keynote lecture by Mary Wheeler** (ICES-Univ. of Texas, USA)
- 14.15 Models and simulations of geochemical kinetics
B. Hamlat, **J. Erhel**, Th. Faney, A. Michel (IFPEN, Inria, France)
- 14.40 Stability and Precision of Numerical Simulation of Low Salinity Water Flooding
H. Al-Ibadi, K. Stephen, E. Mackay (Heriot Watt Univ. UK)
- 15.05 A stabilized fs-fem formulation for 3d static solid mechanics problems
D. Colombo (IFPEN, France)
- 15.30 Break

Session 5 - Model coupling (FSI, THM, CHT)

- 15.50 **Keynote lecture by Francisco Chinesta** (Ecole nationale supérieure des Arts et Métiers, France)
- 16.35 Process analysis in thermal process engineering in grate ring with high-performance computing
A-W Mainassara Chekaraou, A. Rousset, B. Peters, X. Besseron, Ch. Galetti, A. Lupi (Univ. of Luxembourg/FSTC, France ; Univ. of Pisa/DICI ; AB Energy, Italy)
- 17.00 A Scalable Block Preconditioner for Thermo-Hydro-Mechanics Problems
N. Tardieu, A-C Ordonez Egas (EDF, CNRS, CEA, ENSTA, France)
- 17.25 An iterative coupling scheme between a fluid flow basin simulator and a finite element mechanical code for Hydromechanical simulations of sedimentary basins evolution
D. Colombo, **J. Frey**, N. Guy, A. Bruch (IFPEN, France)

Friday 6 December

- 08.30 Opening of the welcome desk

Session 6 - High performance architectures and applications

- 09.00 **Keynote lecture by Pedro Valero** (Cray Inc, USA)
- 09.45 Title to come
E. Petit, P. Oliveira, Y. Chatelain, D. Defour (Intel, Univ.of Versailles, Univ.of Perpignan, France ; Exascale Computing research)
- 10.10 Shaman: A direct and deterministic approach to access floating-point accuracy
N. Demeure, C. Chevalier, Ch. Denis, P. Jacques Dossantos-Uzarralde (CMLA, ENS, CNRS, CEA, Univ. Paris-Saclay, France)
- 10.35 Architecting I/O intensive HPC software at the era of Exascale Computing: a case study on seismic applications
S. Moustafa, W. Kirschenmann, V. Mille (Aneo, France)
- 11.00 Break

- 11.15 Introducing multi-level parallelism, at coarse, fine and instruction level to enhance the performance of iterative solvers for large sparse linear systems on Multi and Many core architecture
J-M Gratien (IFPEN, France)
- 11.40 Performance Study of SpMV (LASs Library)
S. Catalan, T. Usui, X. Martorell, J. Labarta, P. Valero-Lara (Barcelona Supercomputing Center, Spain ; Fujitsu Limited, Kawasaki, Japan ; Univ. Politecnica de Catalunya, Spain)
- 12.05 Closing address