43rd Woudschoten conference

One-minute poster session

14:15-15:00 Line up in alphabetical order

DUTCH-FLEMISH
SCIENTIFIC
COMPUTING SOCIETY

Modelling turbulent combustion coupled with conjugate heat transfer in OpenFOAM

M. el Abbassi, D.J.P. Lahaye and C. Vuik

- Investigate flame-wall interaction with OpenFOAM.

Gas region: Favre averaged transport equations

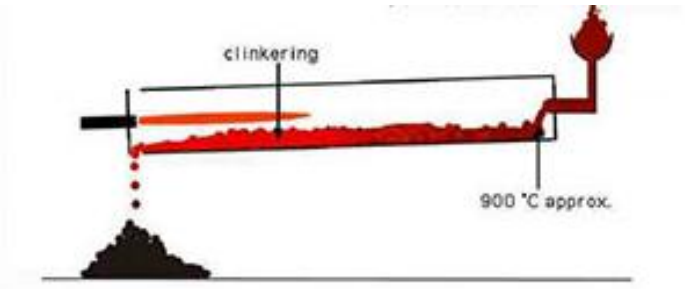
mass, momentum, enthalpy and chemical species

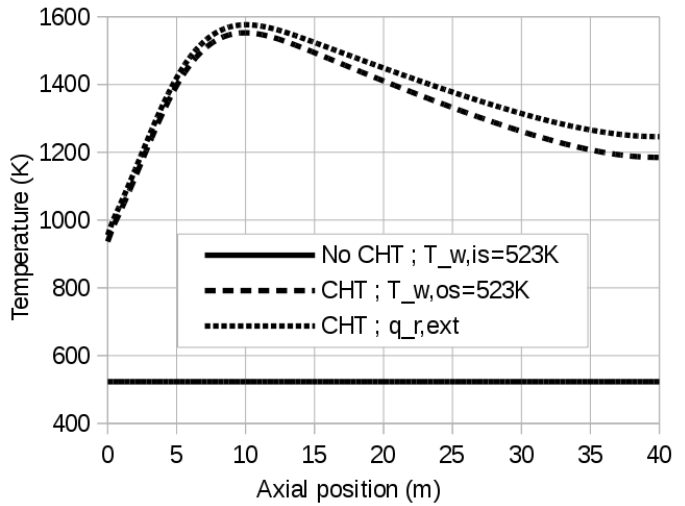
Solid region: Heat equation

$$\frac{\partial(\bar{\rho}h)}{\partial t} = \nabla \cdot (\lambda_s \nabla T)$$

Interface conditions

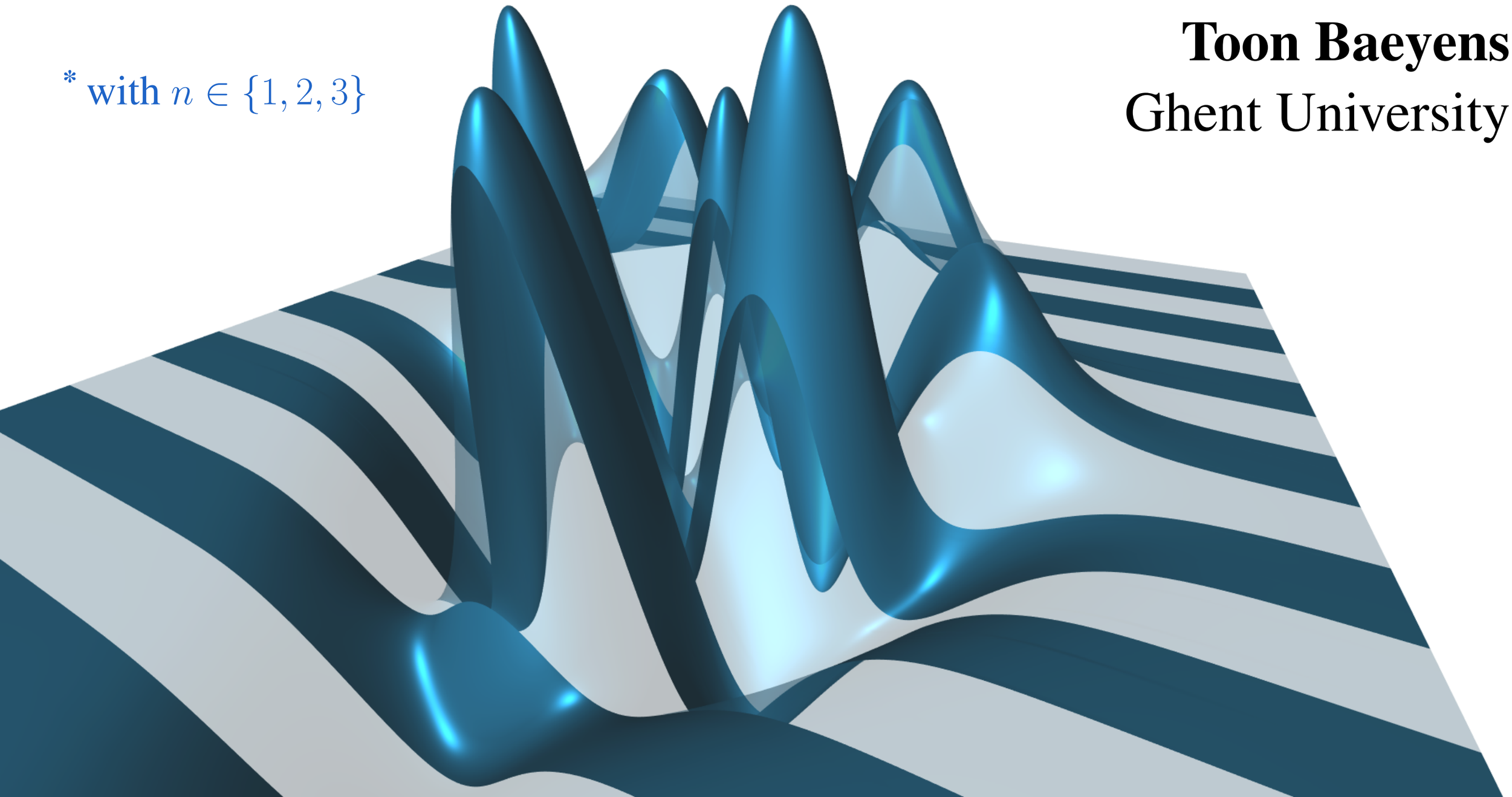
$$T_{f,int} = T_{s,int}, \quad \lambda_f \frac{\partial T_f}{\partial y}\bigg|_{int} = \lambda_s \frac{\partial T_s}{\partial y}\bigg|_{int}$$





Numerical solutions to the n-dimensional* Schrödinger equation using MATSLISE

* with $n \in \{1, 2, 3\}$



Toon Baeyens
Ghent University

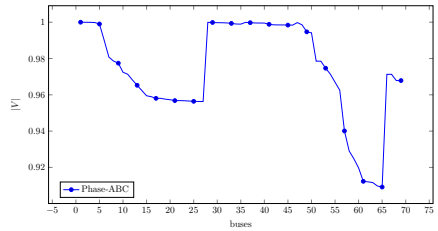
Four mathematical formulations of the (Optimal) Power Flow problem and their impacts on the performance of solution methods

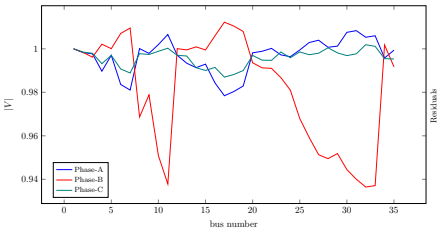
B. Sereeter[*,†], C. Vuik[†] and C. Witteveen[†]

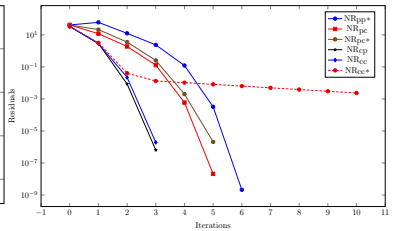
[*]Email: B.Sereeter@tudelft.nl

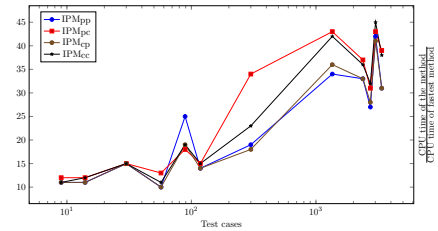
[†]Faculty of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology

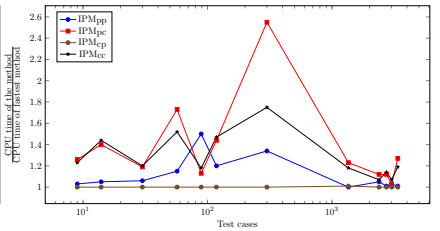
October 3-5, 2018











Somewhere over the ADI rainbow...

Lynn Boen, Karel in 't Hout

Universiteit Antwerpen

University of Antwerp

AM

2D Merton Jump-Diffusion Model

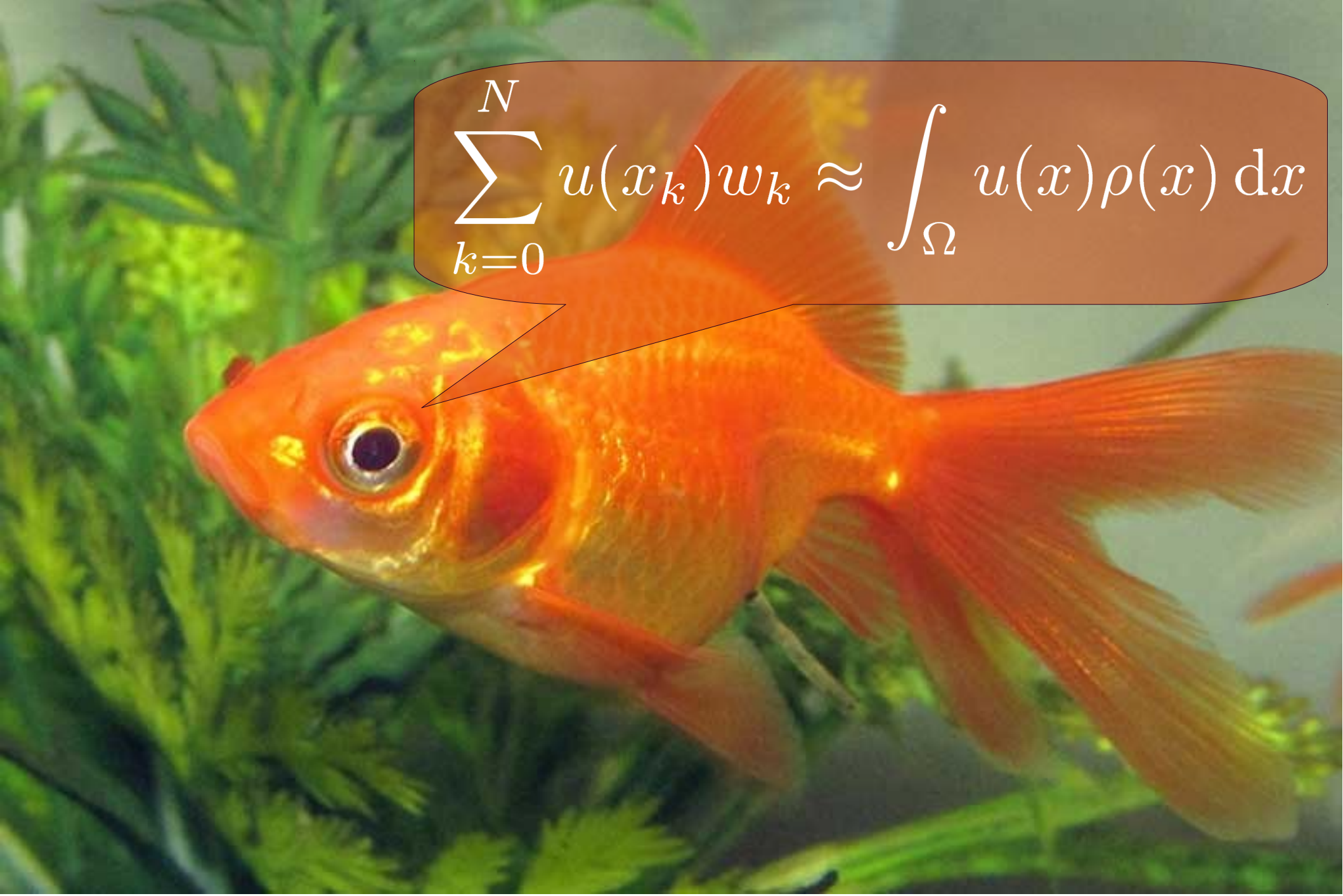
Rainbow Options

Partial Integro-Differential Equation

P I D E

Alternating Direction Implicit

A D I



The Implicit Quadrature Rule for Uncertainty Propagation

Laurent van den Bos

CWI
Centrum Wiskunde & Informatica

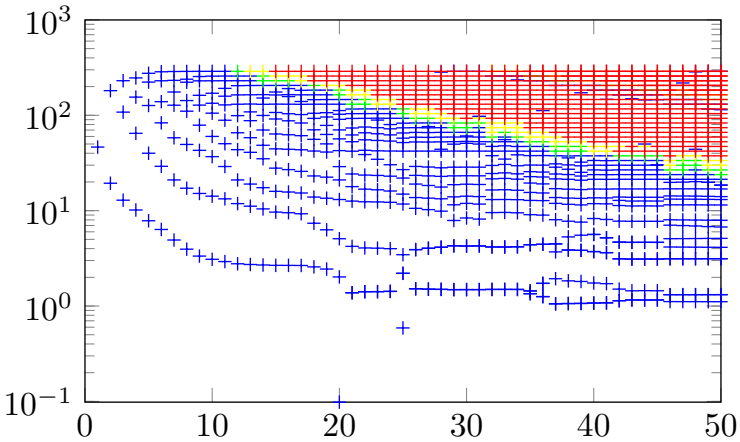
Biorthogonal Extended Lanczos Iteration

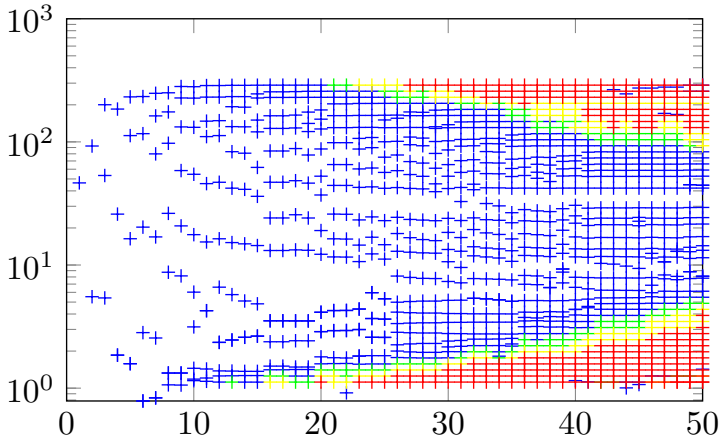
$$\underline{A}$$

$$W^H A V I = T$$

$$\underline{A, A^{-1}}$$

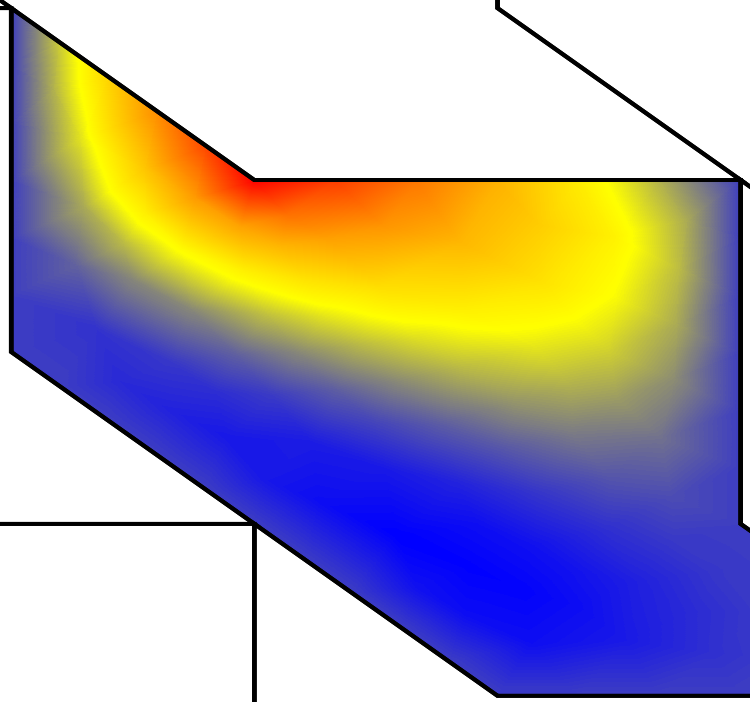
$$W^H A V S = T$$





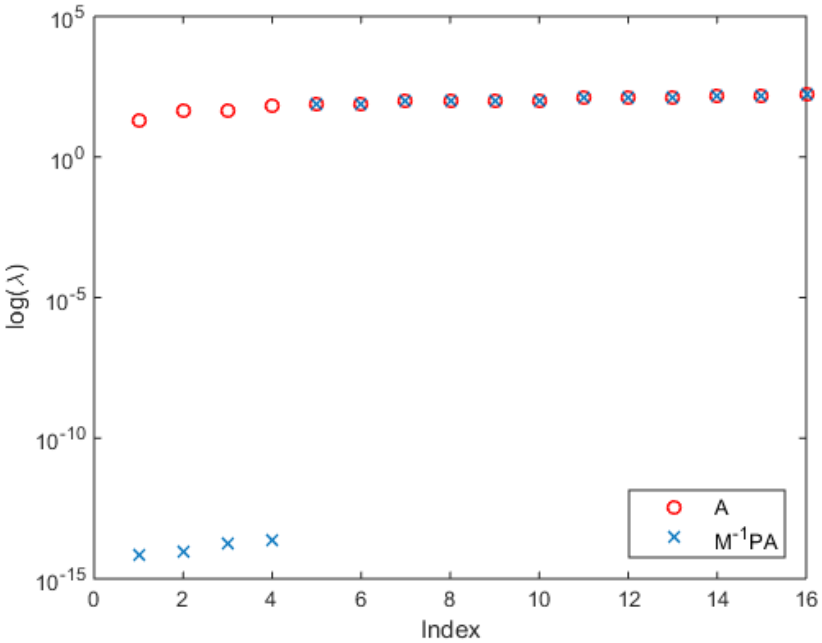
Comparing polynomial with virtual elements for polygonal Discontinuous Galerkin methods

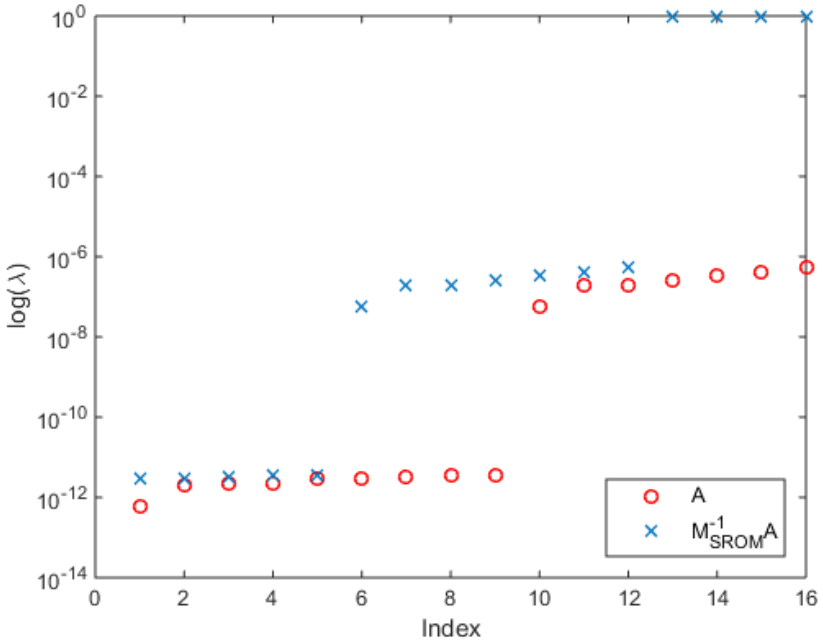
L. J. Corbijn van Willenswaard
University of Twente



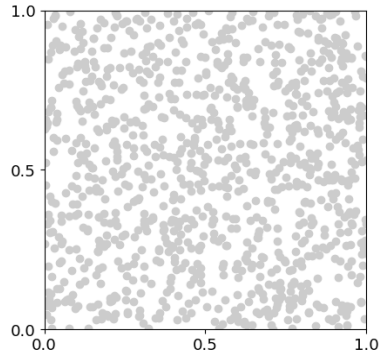
Comparison of 2L-PCG using POD-based Deflation techniques.

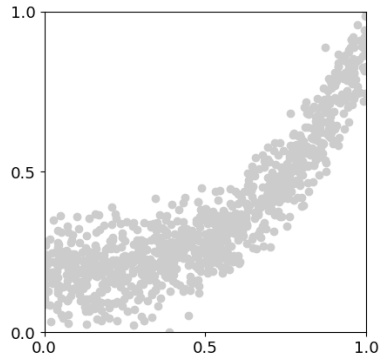
G. Diaz, J. Tjan, C. Vuik and J. D. Jansen [1] and D. Pasetto [2] M. Ferronato [3] M. Putti [3]

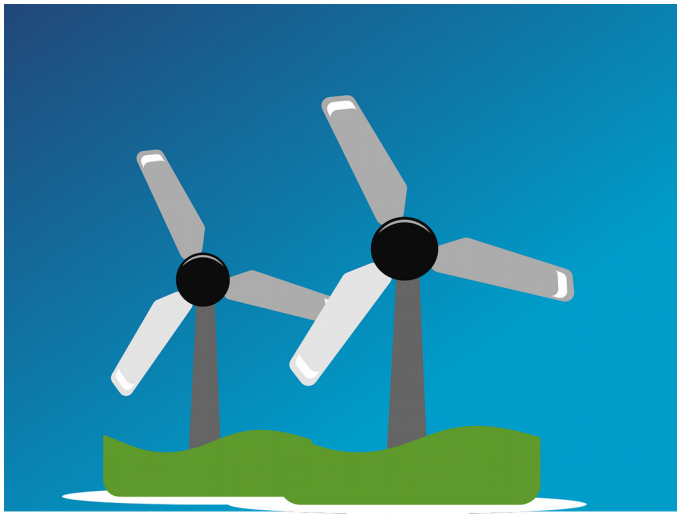




Uncertainty Quantification for dependent inputs







Anne Eggels

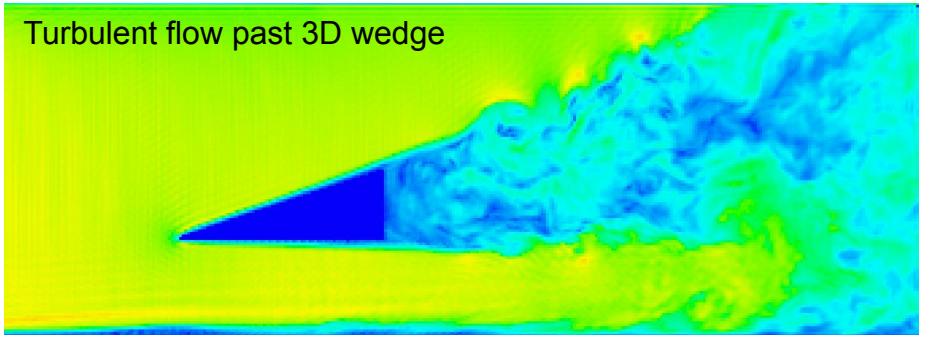
CWI

Simulating real world fluid flows
Using a GPU accelerated Lattice Boltzmann method

Real world fluid flows
- Multi-phase (water-air)
- Multi-scale (turbulence)
- Complex geometries

GPU acceleration
- Massive parallelization
- Multi-GPU & multi-node
- CUDA-Aware MPI
- Halos exchange

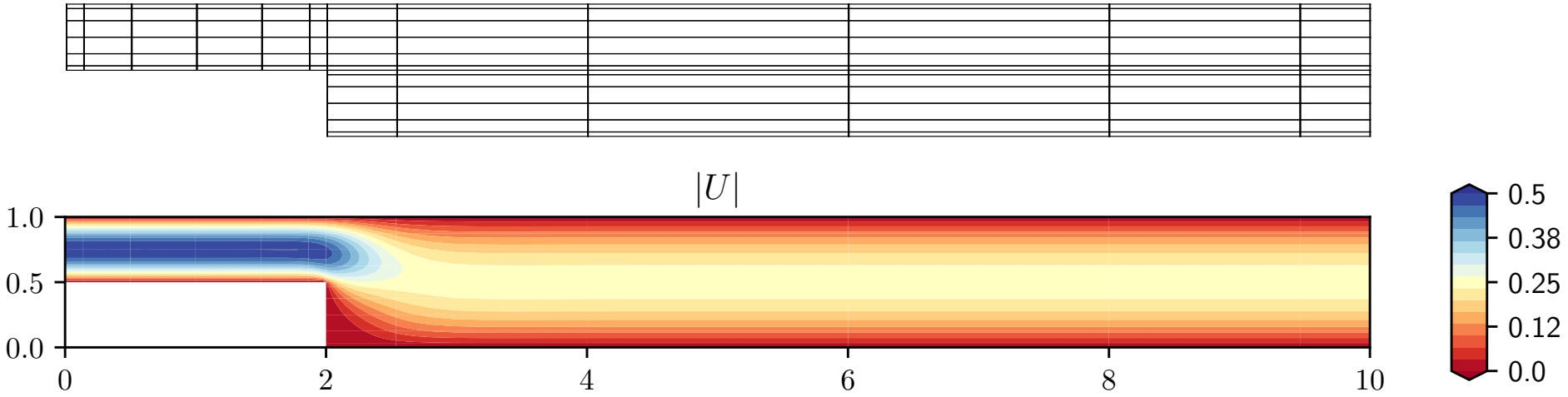
Lattice Boltzmann method
- Mesoscopic method
- Straightforward calculation
- High degree of parallelism



TU Delft Delft University of Technology

Comparing the application of the Mimetic Spectral Element Method to Stokes flow in two formulations

Joel Fisser



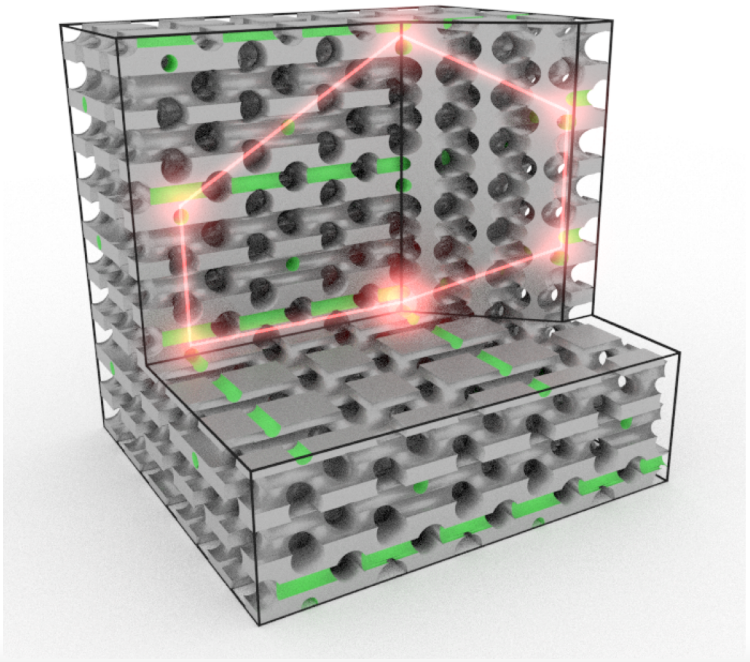
- Mimetic discretization of integral quantities
- Aim for conservation laws (mass, linear and angular momentum) to hold at the discrete level

- Solving for different quantities:
  - Velocity, vorticity, pressure
  - Total stress

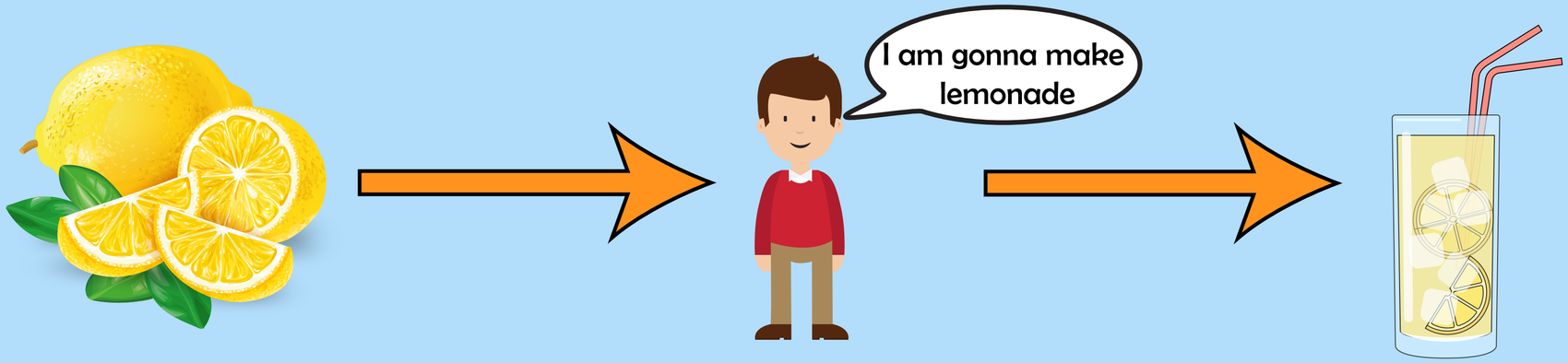
“Cartesian” light: Unconventional propagation of light in a 3D superlattice of bandgap cavities

Sjoerd A. Hack

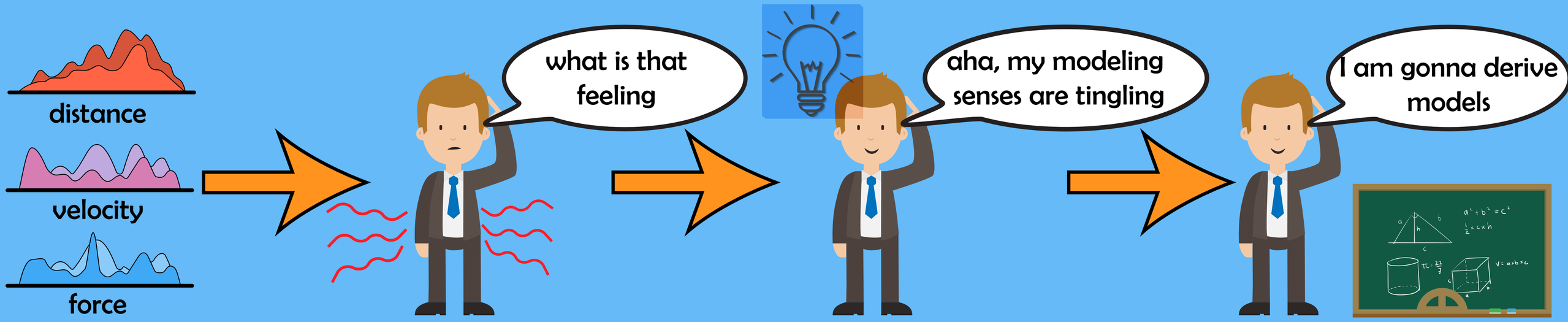
Complex Photonic Systems (COPS)
Mathematics of Computational Science (MACS)
MESA+ Institute for Nanotechnology
University of Twente
Enschede



When life gives you lemons



When life gives you data



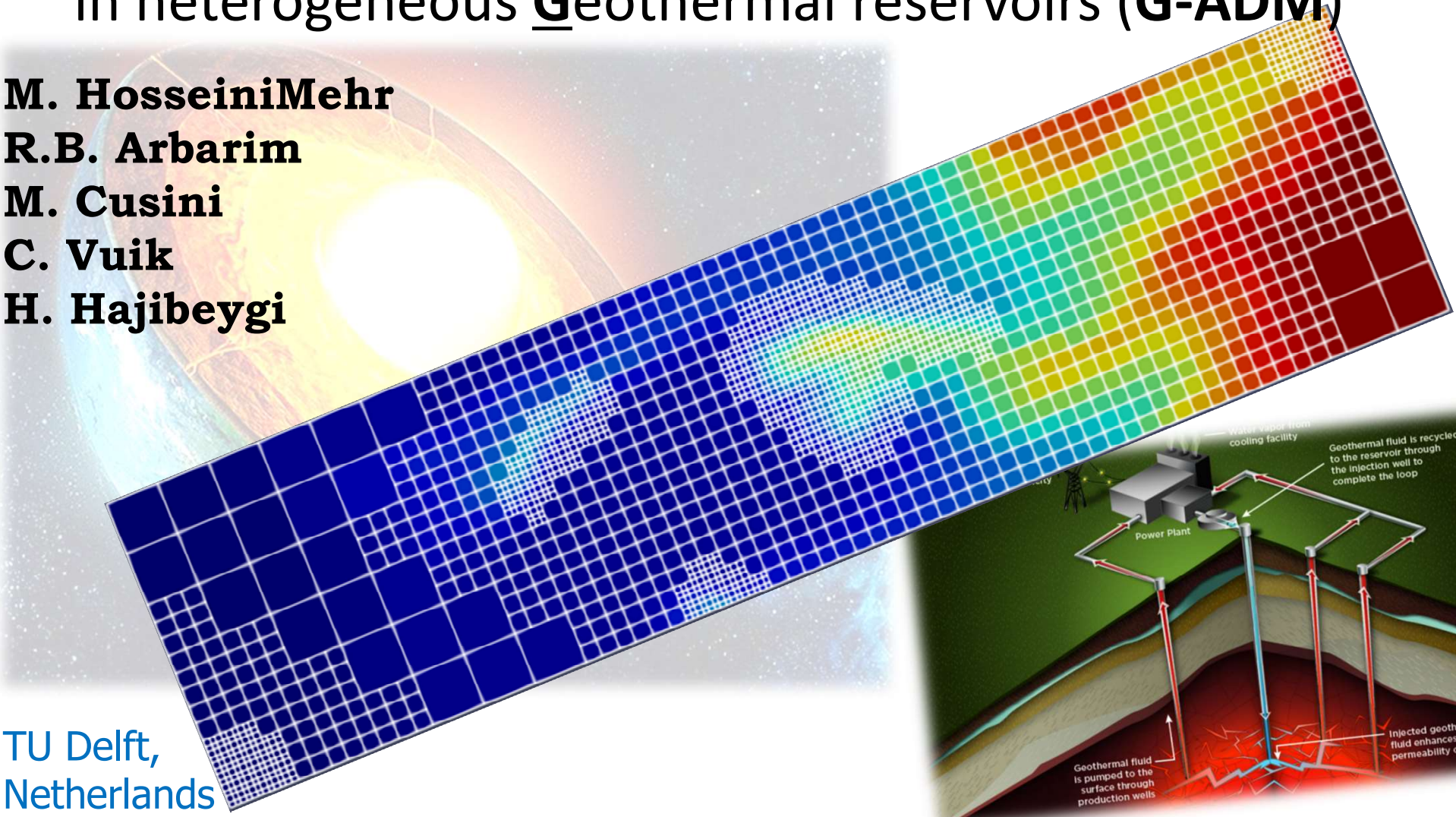
Woudschoten
03-05 October 2018

DARSim
Delft Advanced Reservoir Simulation

Algebraic Dynamic Multilevel method for fluid flow in heterogeneous Geothermal reservoirs (**G-ADM**)

M. HosseiniMehr
R.B. Arbarim
M. Cusini
C. Vuik
H. Hajibeygi

TU Delft,
Netherlands



Universiteit Utrecht

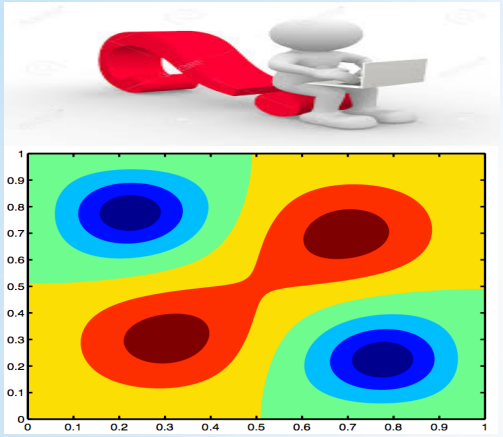
An Efficient Multigrid Scheme for Nonlinear Elliptic BVPs

Indefinite Jacobian system and loss of diagonal dominance

Convergence problems for obtaining solutions for different parameter value

Which method as a smoothing relaxation

New types of periodic and semi-periodic solutions



Sehar Iqbal (s.iqbal@uu.nl)
Mathematical Institute, Utrecht University

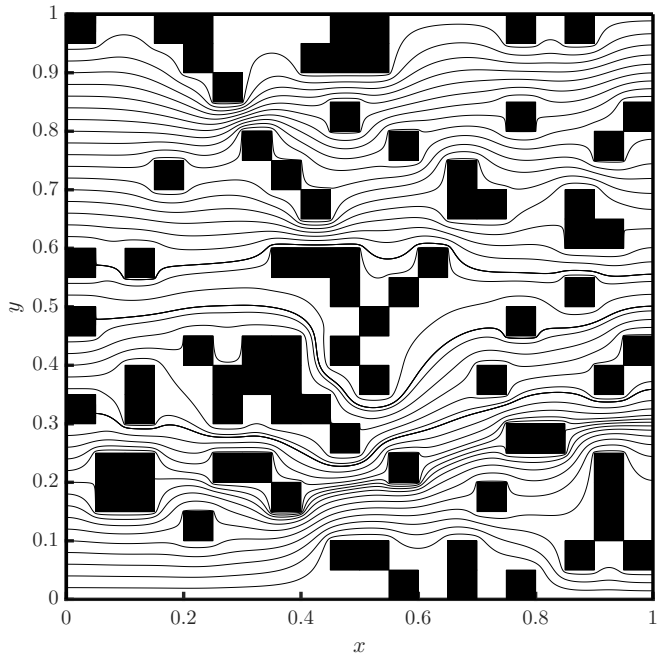
Development of conservative discretization schemes:

Application to multiscale reservoir modelling

Finite volume methods → mass conservation

What about other conservation laws ?

- Linear momentum
- Angular momentum
- Etc…

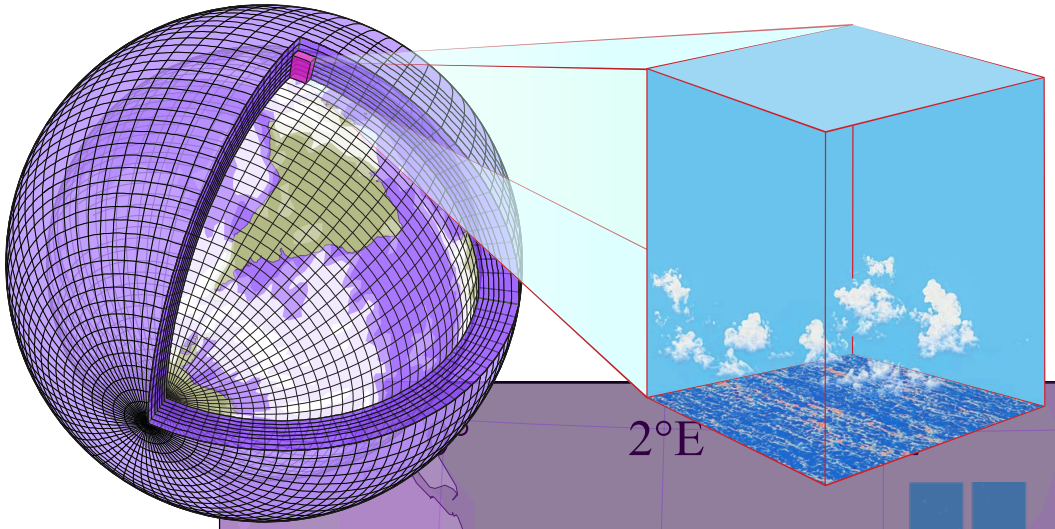


Varun Jain
PhD Aerodynamics, TU Delft
v.jain@tudelft.nl

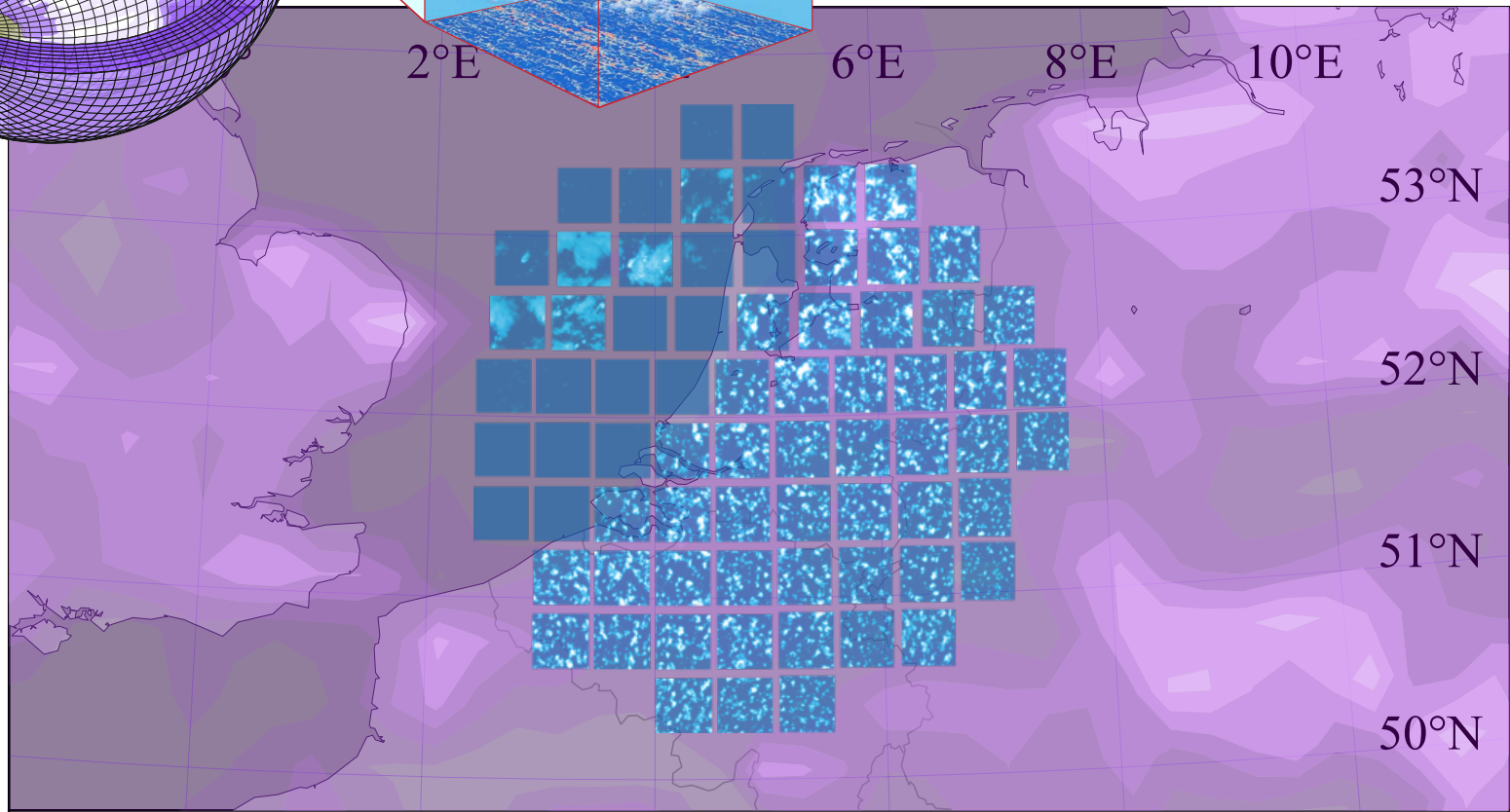
Resolving clouds in a global atmosphere model

Fredrik Jansson, Gijs van den Oord, Inti Pelupessy, Johanna Grönqvist,
Maria Chertova, Daan Crommelin, Pier Siebesma

OpenIFS
Global
Weather
Model

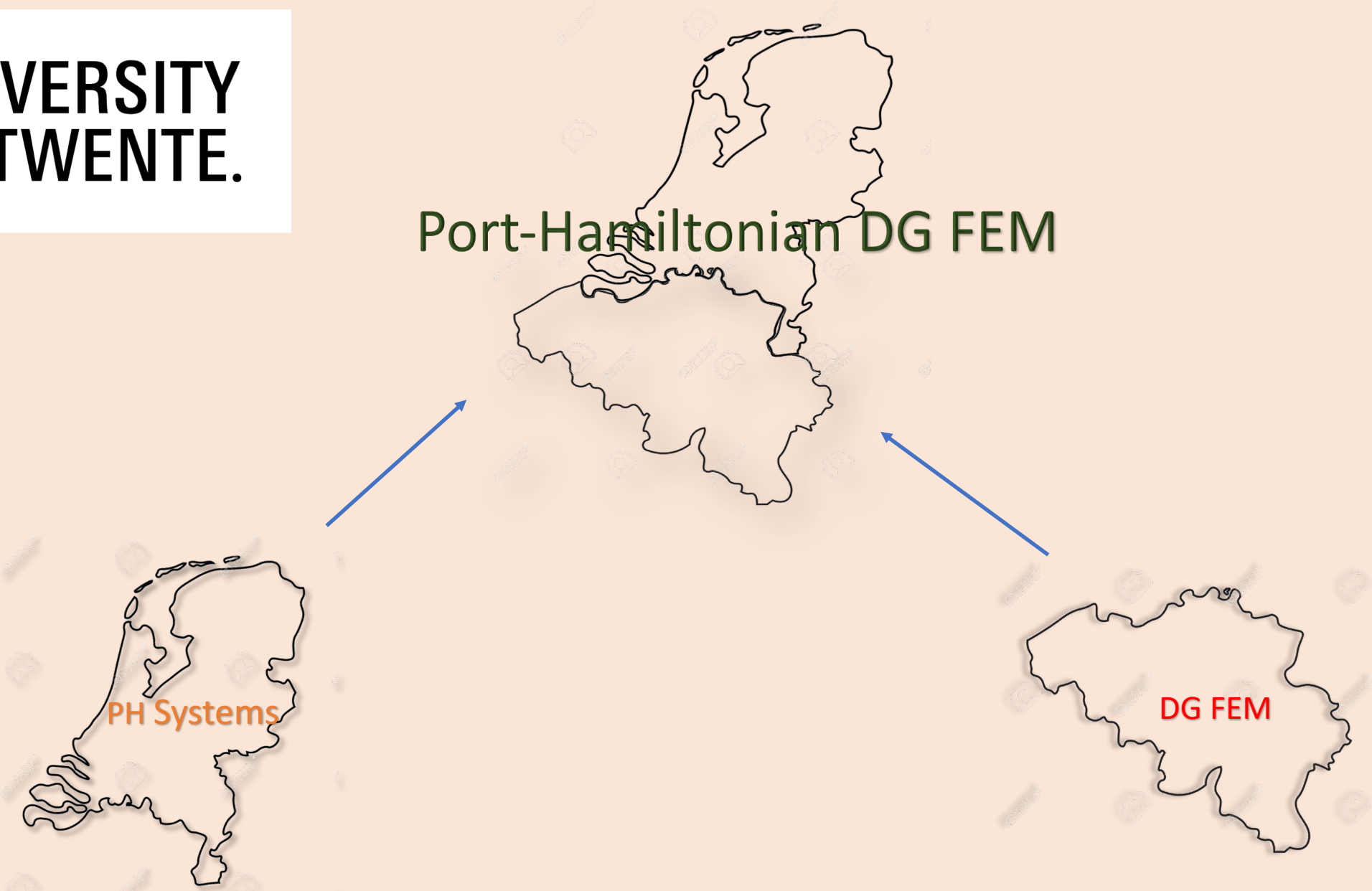


DALES
3D Large
Eddy
Simulation



CWI
netherlands eScience center
KNMI
TU Delft

UNIVERSITY OF TWENTE.



Port-Hamiltonian DG Finite Element Method for Seismic Wave Computations

Nishant Kumar, Jaap van der Vegt and Hans Zwart

How do we build better turbulence models?

$$\frac{\partial \overline{u_i' u_j'}}{\partial x_j} = ??$$

Prashant Kumar

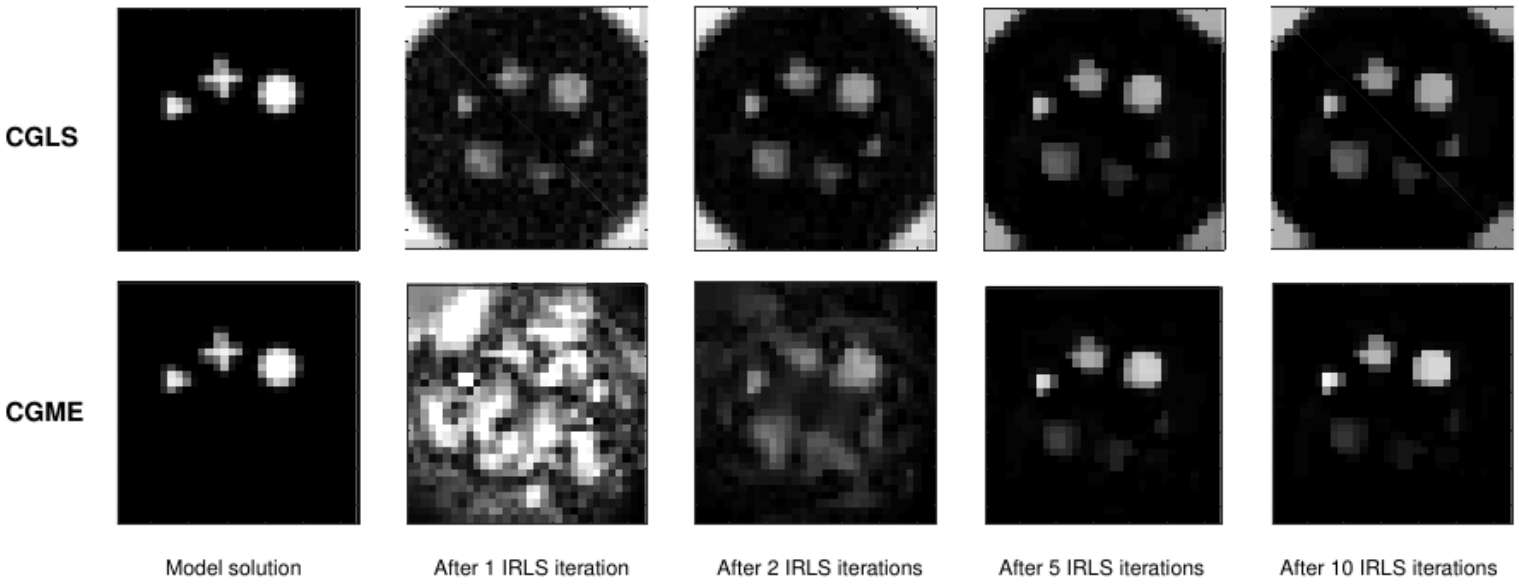
TU Delft

CWI
Centrum Wiskunde & Informatica

A comparison of CGLS and CGME for low field MRI

Merel de Leeuw den Bouter, Martin van Gijzen, Rob Remis

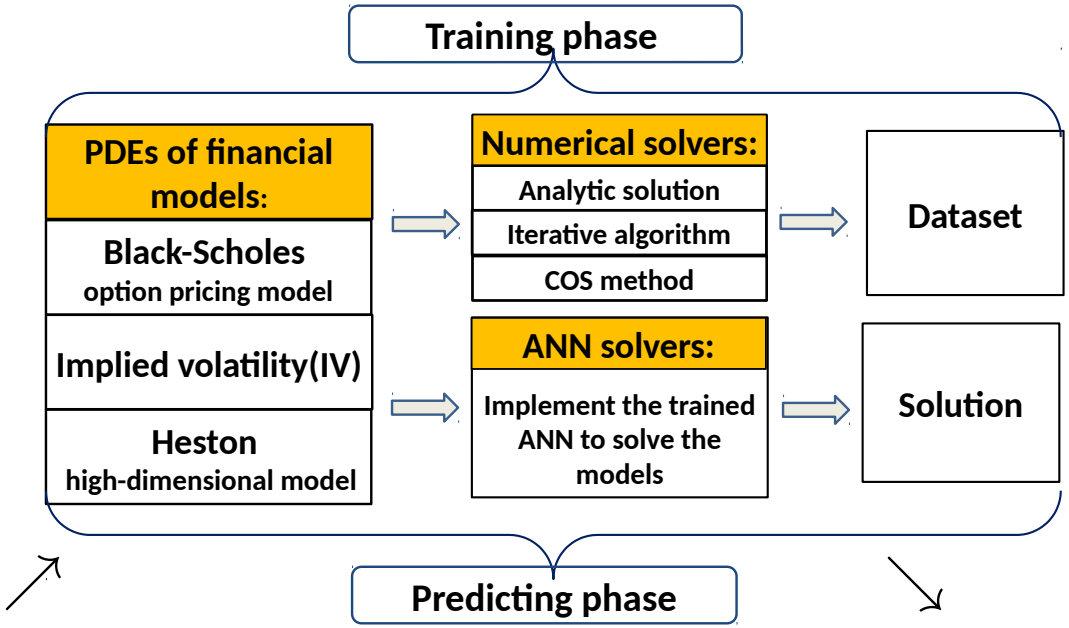
$$\mathbf{x}^* = \arg\min_{\mathbf{x}} \frac{1}{2}\|\mathbf{b} - A\mathbf{x}\|_2^2 + \frac{1}{2}\lambda\|R\mathbf{x}\|_p^p$$



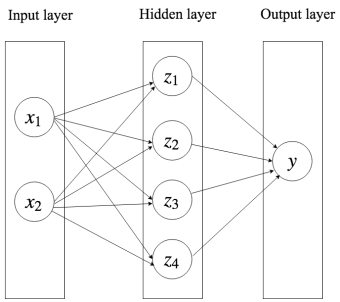
Pricing options & computing implied volatilities using a neural network

Shuaiqiang Liu[†], Cornelis W. Oosterlee[*,†], and Sander M.Bohte[*]

[†]Applied Mathematics, Delft University of Technology;[*] Centrum Wiskunde & Informatica, Amsterdam



A machine-learning method to accelerate option valuation in computational finance.

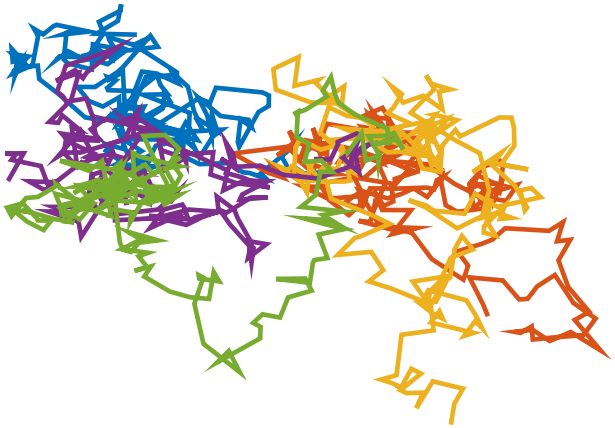


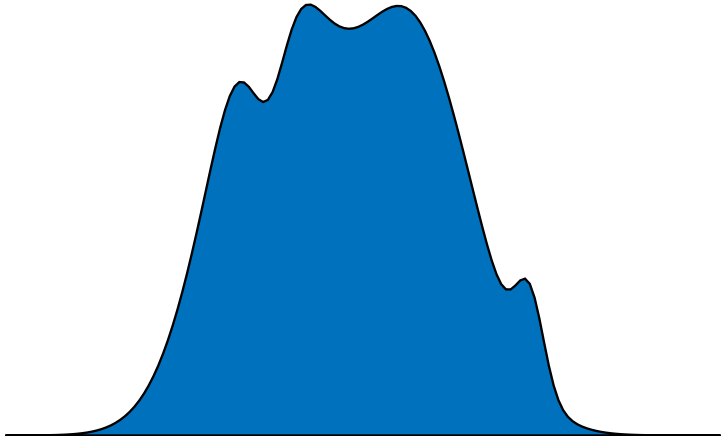
Artificial neural networks(ANN)

Method	GPU (sec)	CPU (sec)	Robustness
Newton-Raphson	19.68	23.06	No
Brent	52.08	60.67	Yes
Bi-section	337.94	390.91	Yes
IV-ANN solver	0.20	1.90	Yes

IV-ANN solver speeds up the computation by **100 times on a GPU**, i.e. calculating 20000 implied volatilities.

E. Løvbak, S. Vandewalle, G. Samaey, KU Leuven

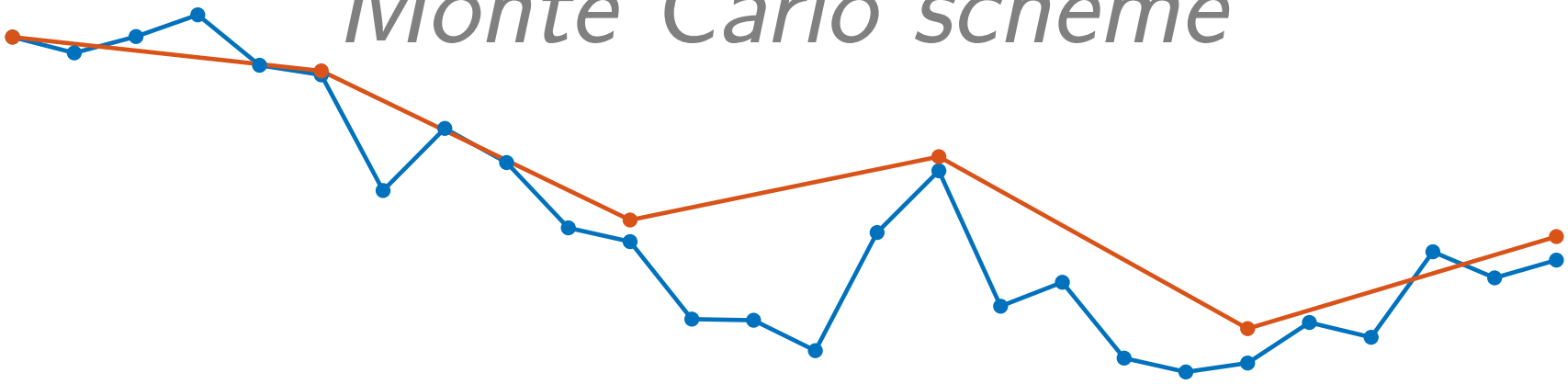




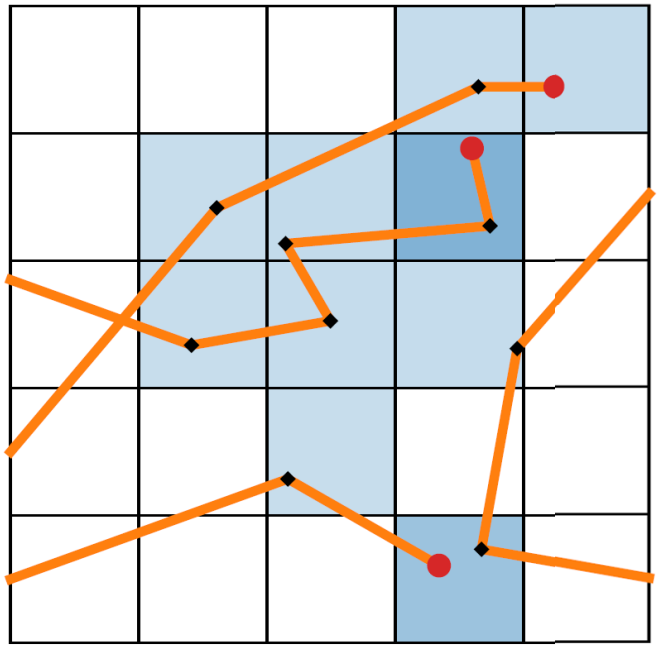
Particles $\Leftrightarrow$ *Continuum*

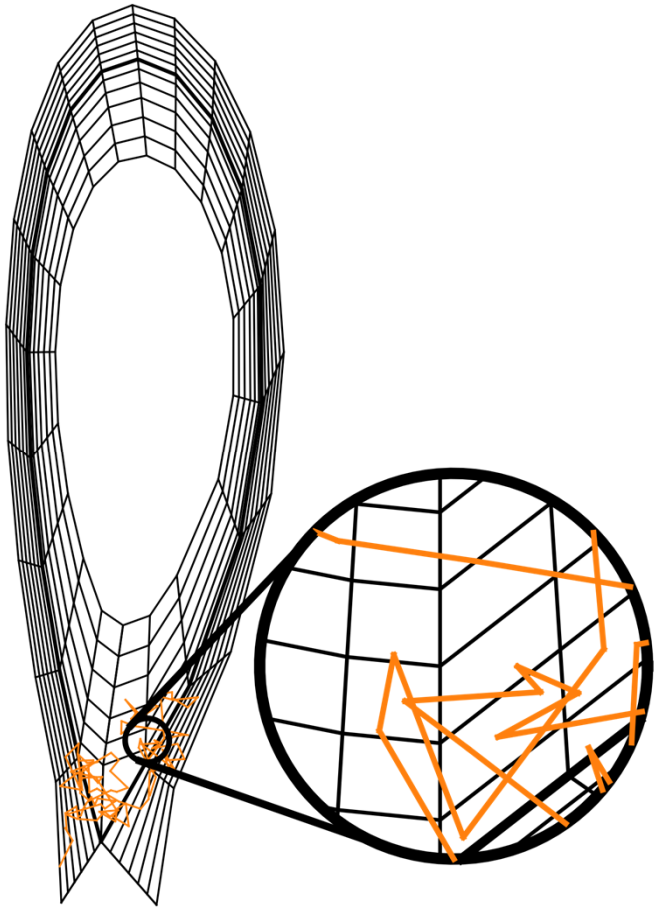
$\Downarrow$

Asymptotic-Preserving Multilevel Monte Carlo scheme



Estimation procedures

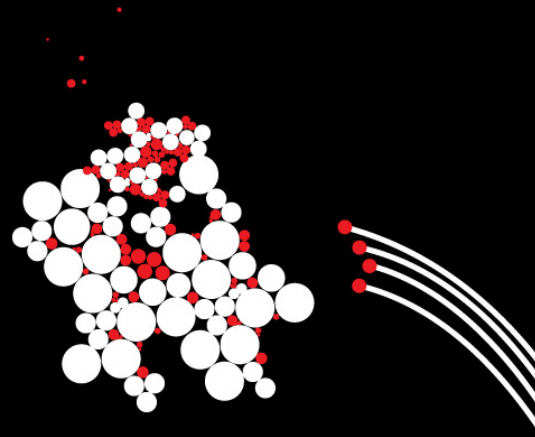




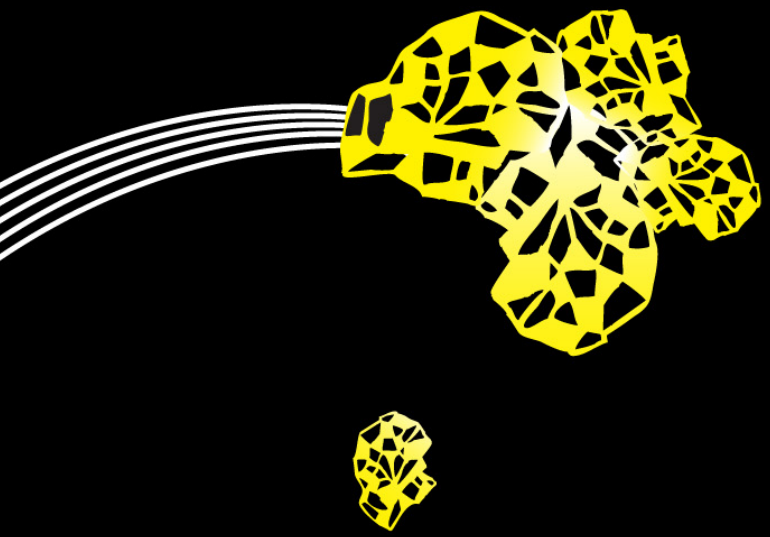
Bert Mortier – KU Leuven

Promotor: Giovanni Samaey

UNIVERSITY OF TWENTE.

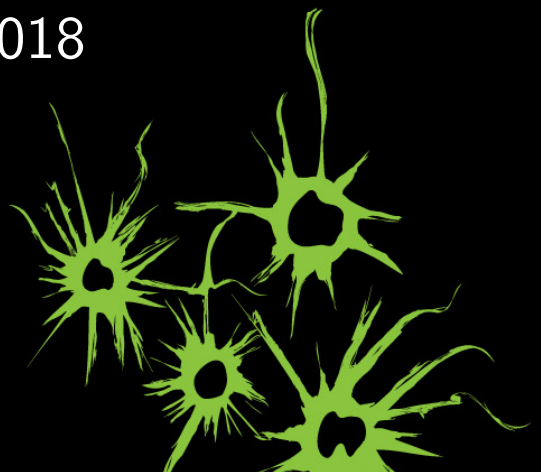


An efficient discretization scheme for the radiative transfer equation based on higher order flux splittings



PhD student: Olena Palii,
Advisor: Dr. Matthias Schlottbom

October 4, 2018



TU Delft

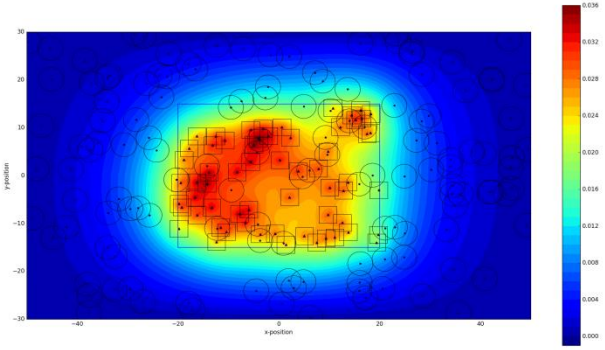
Agent-based Modeling of Contraction of Burns

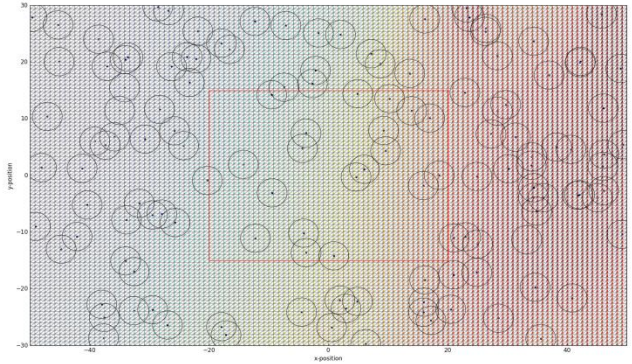
Continuous Cell-Based Model to Mimic Cells' Activities during Wound Healing Process

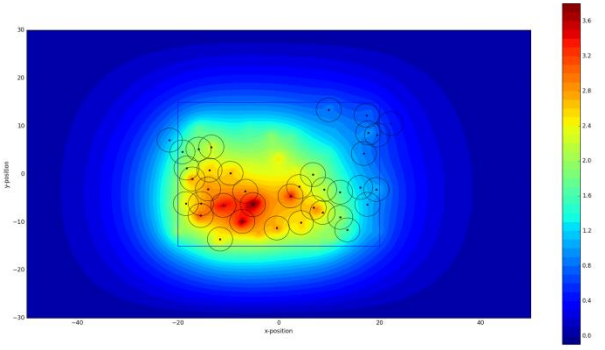
Q.Peng, F.J.Vermolen

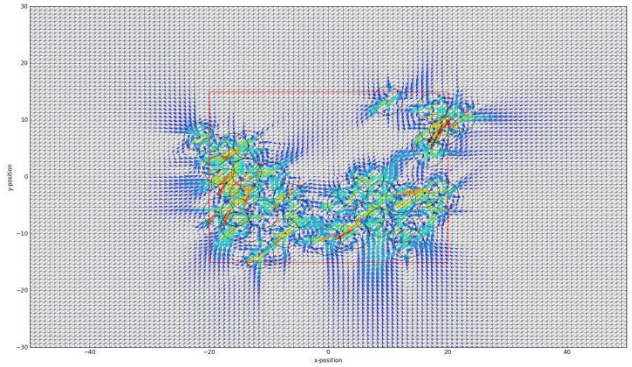
Oct., 2018, Woudschoten, Netherlands

$$\mathrm{d}\mathbf{r}_i(t) = \alpha_i \widehat{M}(\mathbf{r}_i)\hat{\mathbf{z}}_i dt + \mu_c \frac{\nabla c}{||\nabla c|| + \gamma} dt + \sigma d\boldsymbol{W}(t), \forall i \in \{1, \dots, n\}$$









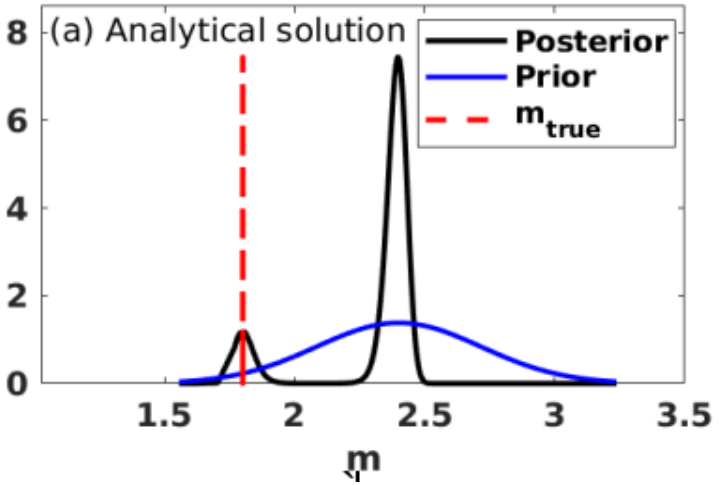
An Unbiased Multiple Semi-Coarsened Multigrid Adaptive Multi-Index Monte Carlo Method for Anisotropic Diffusion Problems

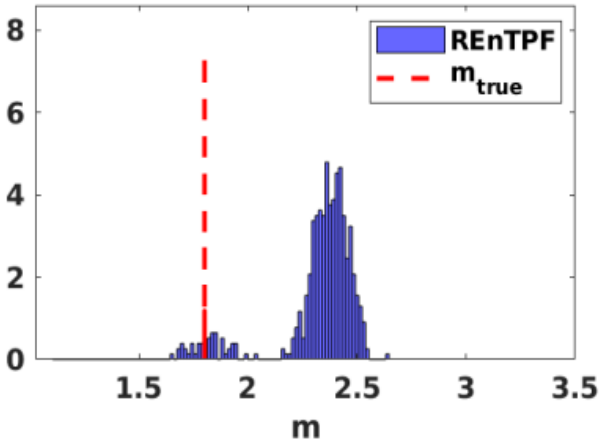
Pieterjan Robbe, Dirk Nuyens, Stefan Vandewalle - NUMA section - KU Leuven

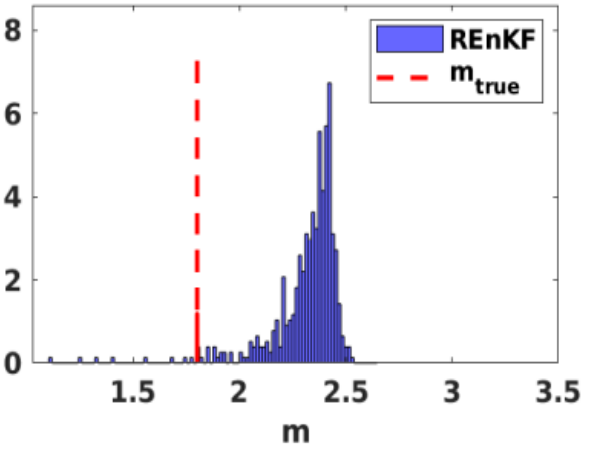
Tempered Ensemble Transform Particle Filter for non-Gaussian elliptic problems

Sangeetika Ruchi, CWI (Scientific Computing)

True posterior distribution

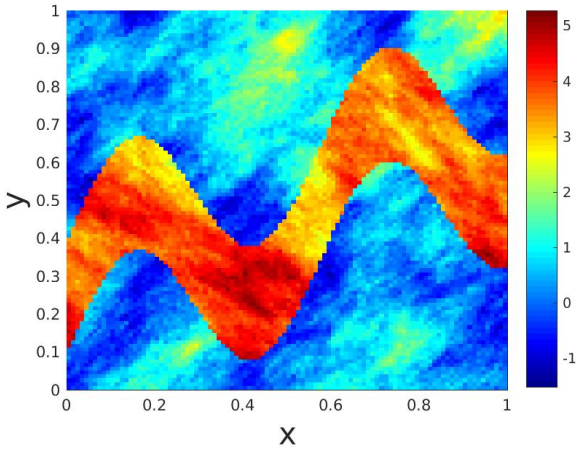




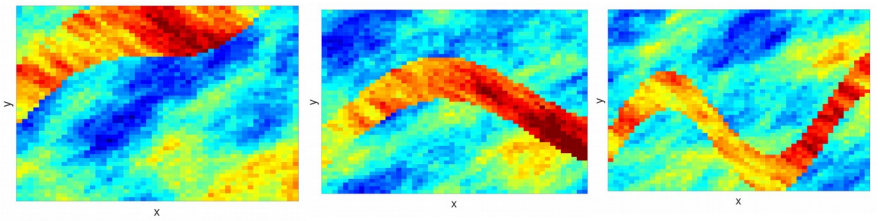


Channel flow

True permeability field



Prior permeability fields



Posterior permeability field

Error Analysis of the Space Time Discontinuous Galerkin Method for the Wave equation

$$\frac{\partial u_1}{\partial t} - \nabla \cdot (A \nabla u_0) = f \qquad \text{in} \quad \Omega \times (0,T)$$

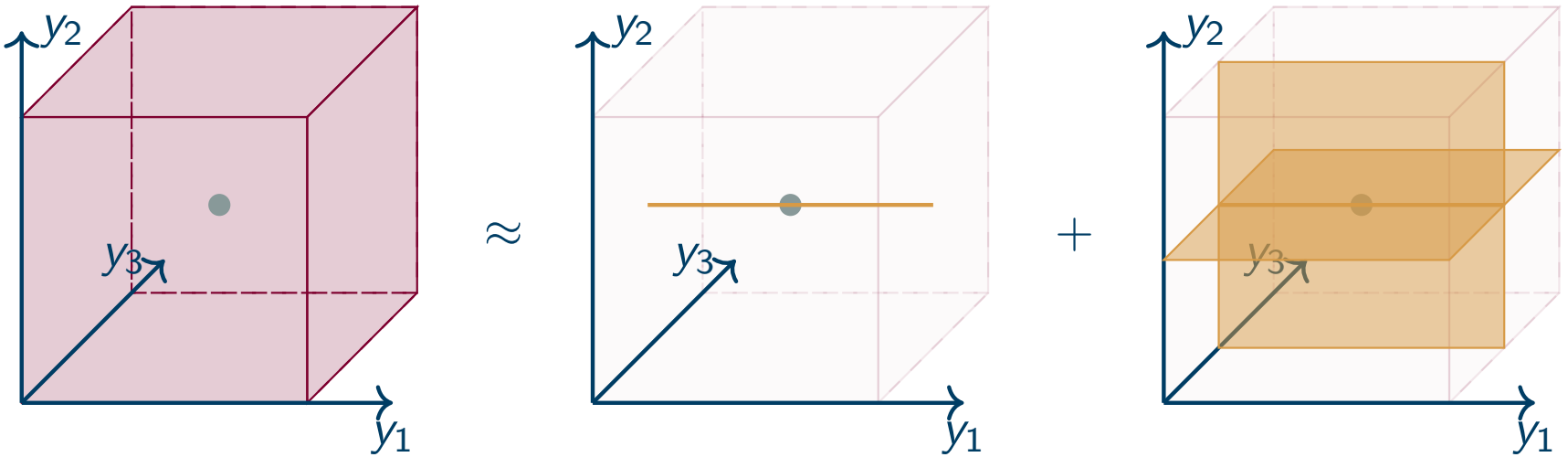
$$\frac{\partial u_0}{\partial t} = u_1 \qquad \text{in} \quad \Omega \times (0,T)$$

$$B_h(u_{0,h}, u_{1,h}; u_{0,h}, u_{1,h}) \geq C||(u_{0,h}, u_{1,h})||^2_{DG}$$

$$||Pe_u||_{DG} \leq Ch^k$$

POORVI SHUKLA
UNIVERSITY OF TWENTE

Numerical valuation of high dimensional Bermudan basket options via partial differential equations



Jacob Snoeijer

University of Antwerp

Finite Volume POD-based Identification *Reduced Order Method* for Control Purposes

Kelbij Star - *kelbij.star@sckcen.be*

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STUDIECENTRUM VOOR KERNENERGIE
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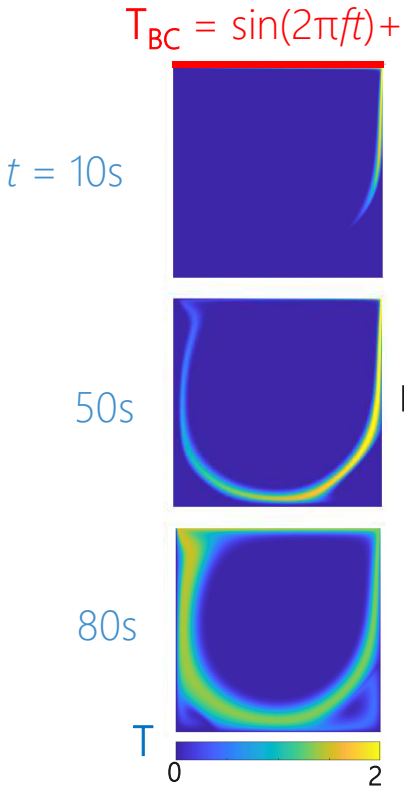
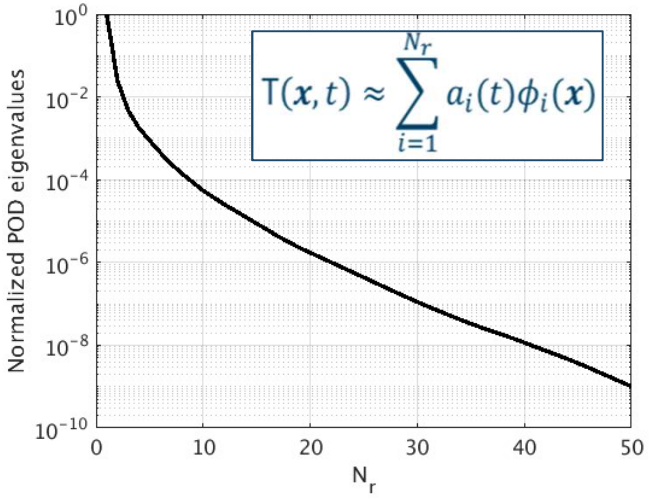


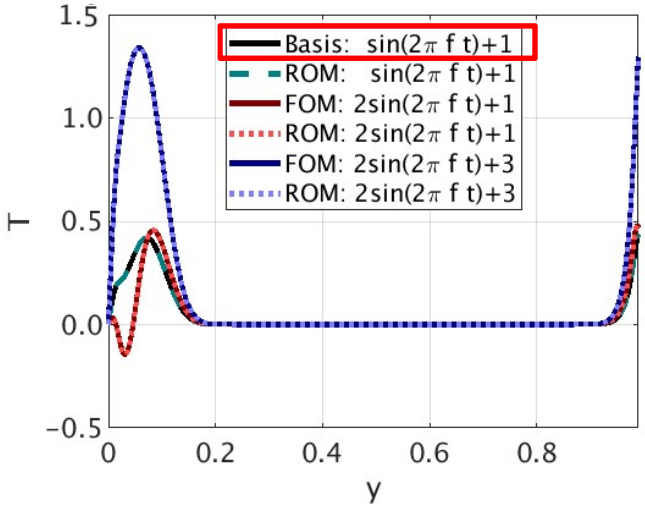
Full Order Solution

$$\frac{\partial T}{\partial t} + \nabla \cdot (\langle \boldsymbol{u} \rangle T) - \nabla^2(\mathscr{D}T) = 0$$



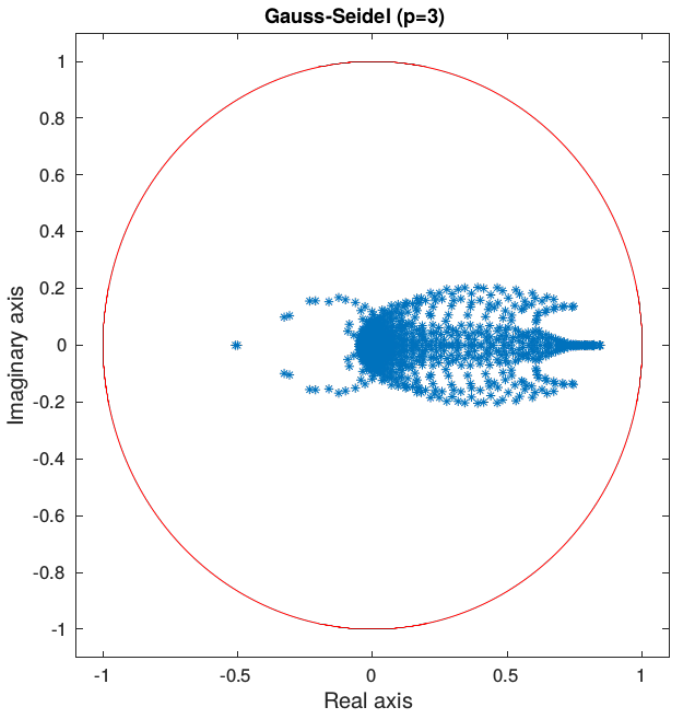
Proper Orthogonal Decomposition

Cross-section temperature field
x =0.5, t = 80s

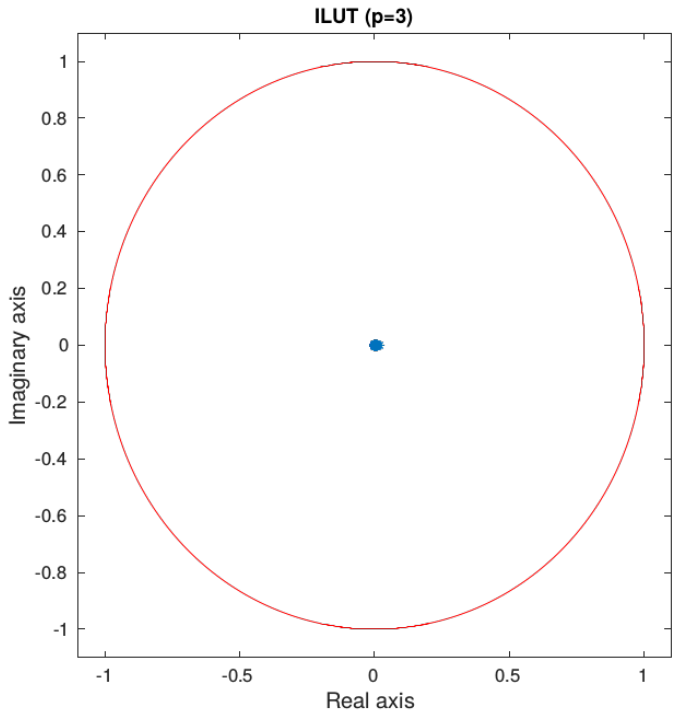


Reduced Order Model *+ Boundary control*

Efficient p-multigrid solvers in Isogeometric Analysis



2017



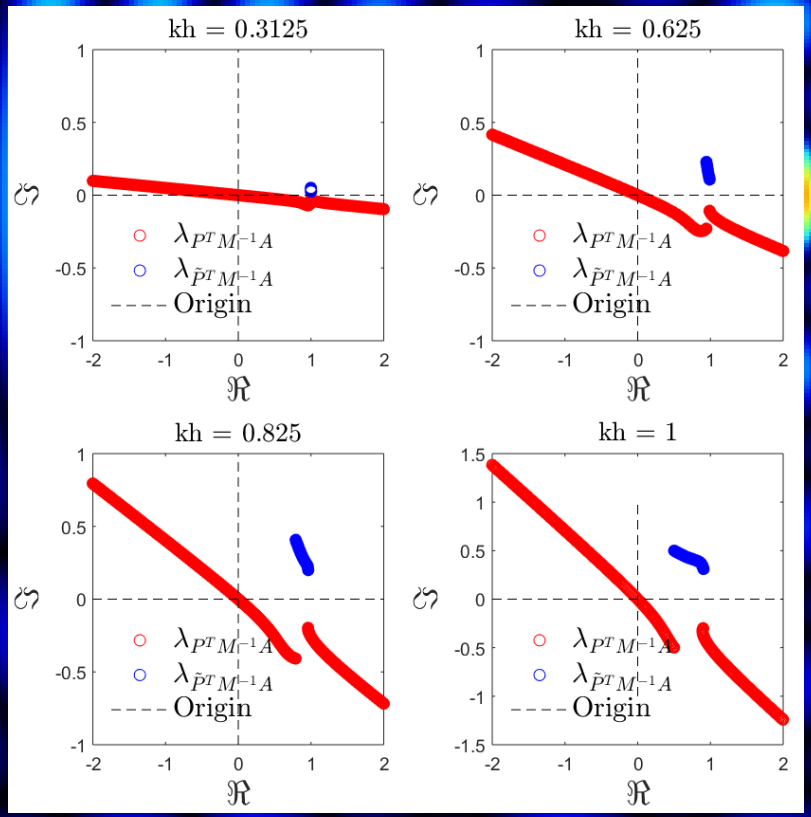
2018

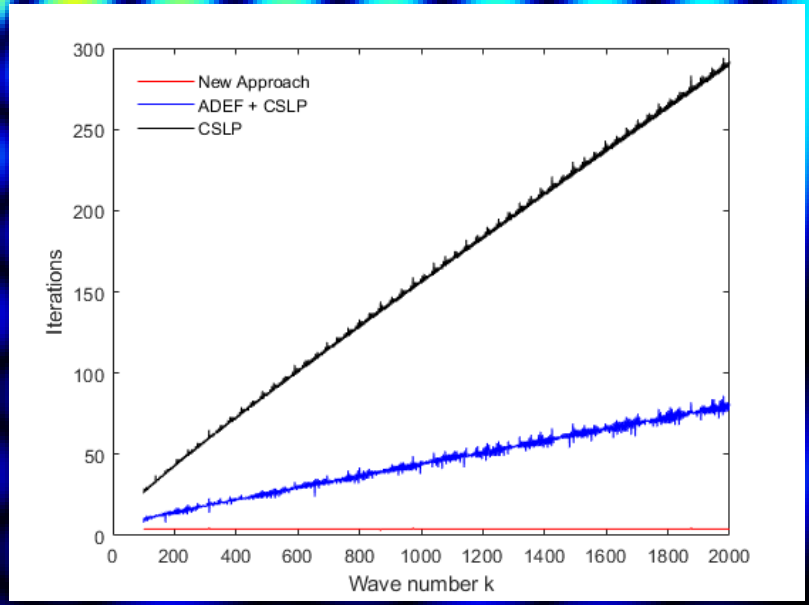
R.Tielen, M. Möller and C. Vuik

Delft Institute of Applied Mathematics, TU Delft

Accelerated Convergence of Helmholtz Solvers

- Vandana Dwarka and Kees Vuik
- Preconditioning using Deflation
- Wave number independent iteration count
- Spectrum clustered near $(1, 0)$.



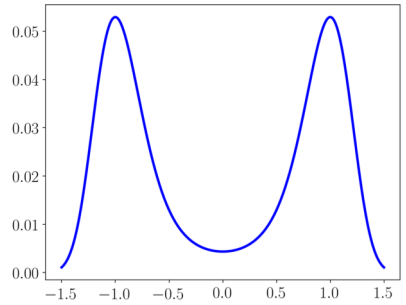


Efficiency of micro-macro acceleration for scale-separated SDEs

Hannes Vandecasteele

$$dX = -(2X + Y)dt + AdW_x$$

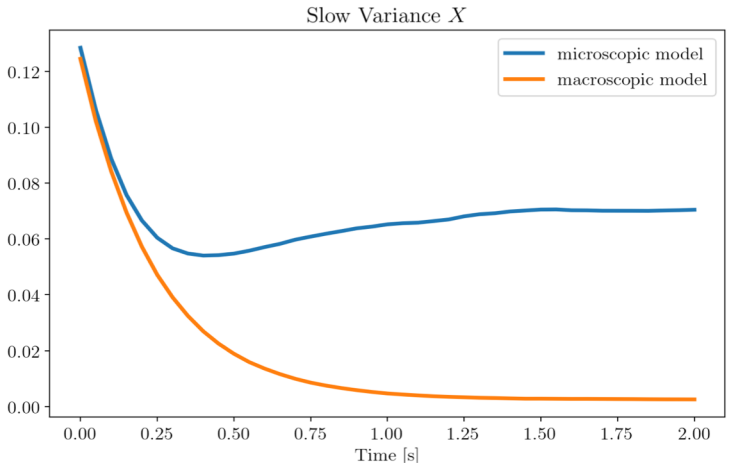
$$dY = -\frac{1}{\varepsilon}(Y^3 - Y)dt + \frac{1}{\sqrt{\varepsilon}}dW_y$$

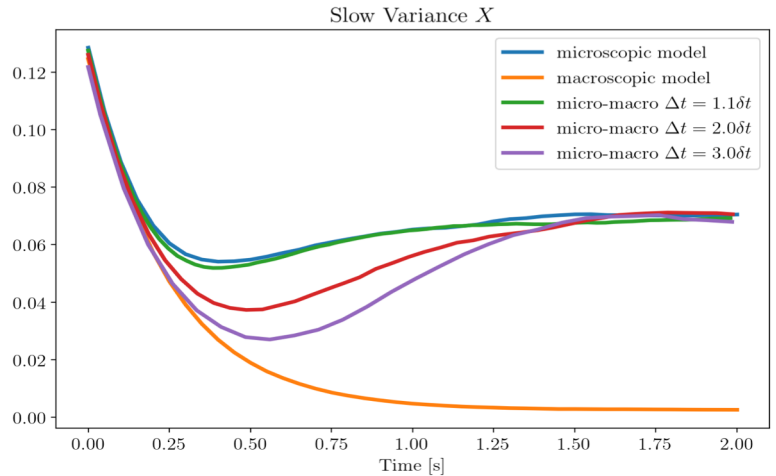


Averaging

Micro-macro acceleration

$$dX = -2Xdt + AdW_x$$





Optimal 2D *hp*-adaptive finite elements in practice

Korteweg-de Vries Institute for Mathematics

Jan Westerdiep (j.h.westerdiep@uva.nl) Rob Stevenson

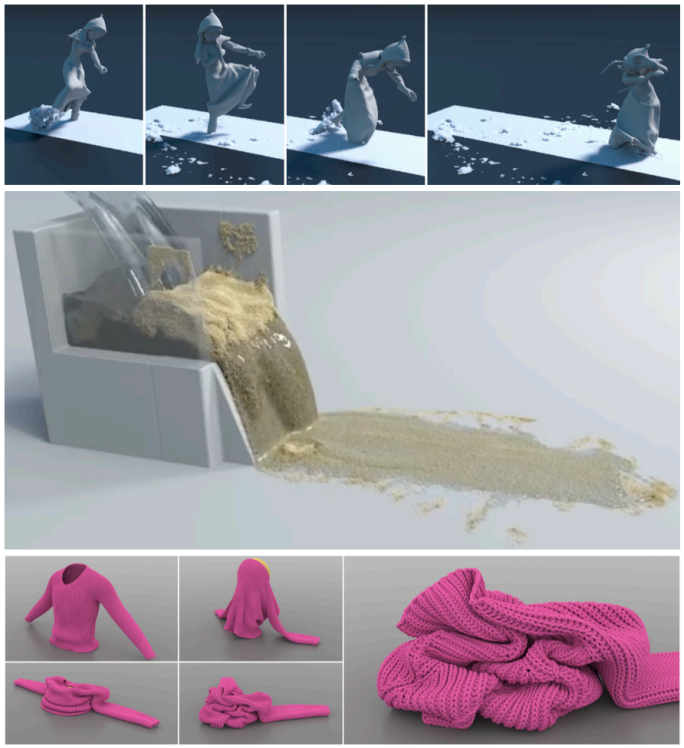
Woudschoten conference, October 4, 2018

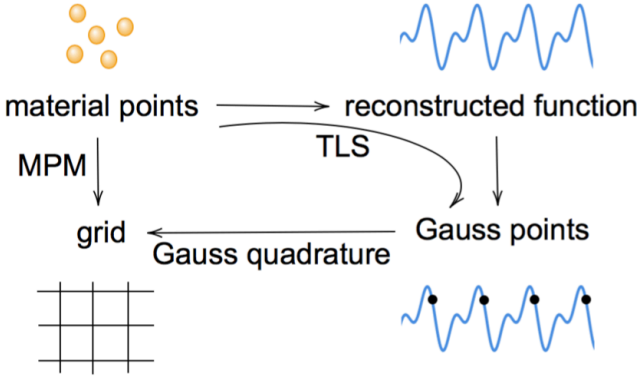
University of Amsterdam

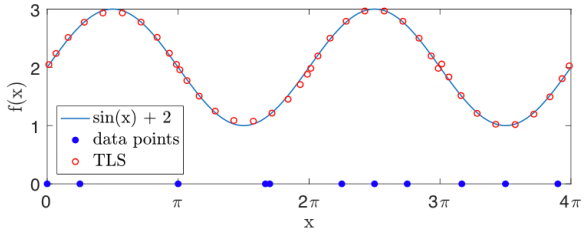
Conservative Taylor Least Squares function reconstruction technique with application to Material-Point Methods

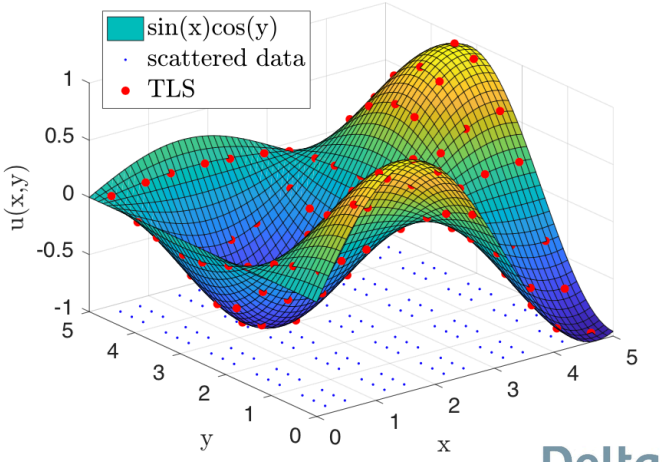
Elizaveta Wobbes, Matthias Möller, Vahid Galavi, Cornelis Vuik

Novel technique
Reconstructs functions from scattered data
Preserves integrals
Improves accuracy of MPMs
Conserves mass and momentum









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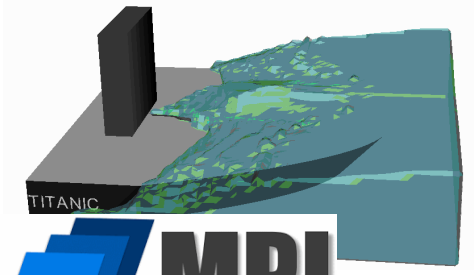

OpenMP MPI

Enabling HPC since 1997

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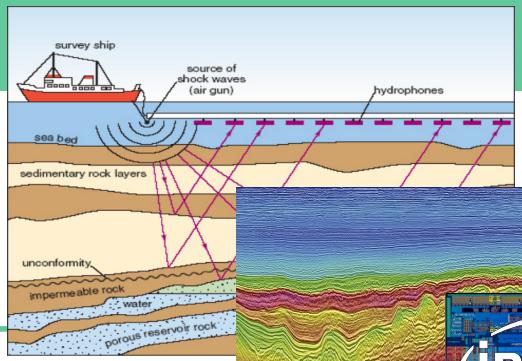

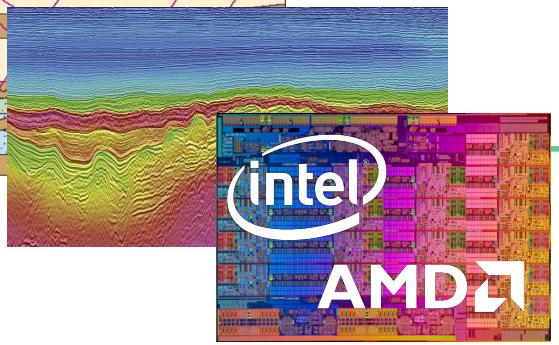

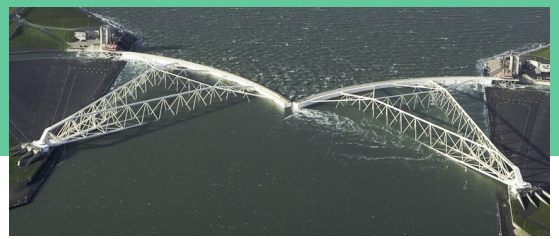

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