Curriculum Vitae

Name Deep Ray

Affiliation Computational Mathematics and Simulation Science (MCSS)
École Polytechnique Fédérale de Lausanne
CH-1015 Lausanne, Switzerland
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Employment

Postdoctoral researcher, MCSS, EPFL
- July, 2017 to present
- Inolved in the development of artificial neural networks to resolve exisiting bottlenecks in numerical methods.

Education

Ph.D. in Mathematics, Tata Institute of Fundamental Research (TIFR-CAM)
- September, 2013 to May, 2017
- Advisors: Dr. Praveen Chandrashekar (TIFR-CAM) and Prof. Siddhartha Mishra (ETH Zurich and adjunct faculty TIFR-CAM)
- Developed and analysed a high-order entropy stable parallelized finite volume solver for the compressible Euler and Navier-Stokes equations on unstructured meshes.

M.Phil in Mathematics, TIFR-CAM
- July, 2012 to September, 2013
- Advisor: Dr. Praveen Chandrashekar
- Worked on numerical schemes for the Euler and Navier-Stokes Equations that preserve entropy, kinetic-energy and vorticity, and performed multi-dimensional simulations for the same.

M.Sc in Mathematics, TIFR-CAM
- August, 2010 to May, 2012

B.Sc (Honours) in Mathematics, Hindu College, University of Delhi
- July, 2007 to June, 2010

Research Visits

Visiting Research Student, Seminar for Applied Mathematics, ETH Zurich
- May to October, 2014 and August 2015 to May 2016
- Visited Prof. Siddhartha Mishra to work with him and his research group.

Publications

Publication in Journals
- An artificial neural network as a troubled-cell indicator.
  D. Ray and J. S. Hesthaven.
  Journal of Computational Physics, Vol. 367 (15), pp 166-191 (2018).
- An entropy stable finite volume scheme for the two dimensional NavierStokes equations on triangular grids.
  D. Ray and P. Chandrashekar.
  Applied Mathematics and Computation, Vol. 314, pp. 257-286 (2017).

- Convergence of fully discrete schemes for diffusive-dispersive conservation laws with discontinuous flux.
  U. Koley, R, Dutta and D. Ray.
  ESAIM: Mathematical Modelling and Numerical Analysis, Vol. 50(5), pp.1289-1331, (2016).
- Entropy stable schemes on two-dimensional unstructured grids for Euler equations.
  D. Ray, P. Chandrashekar, U. S. Fjordholm, S. Mishra.
  Communications in Computational Physics, Vol. 19(5), pp. 1111-1140, (2016).
- A sign preserving WENO reconstruction method.
  U. S. Fjordholm, D. Ray.
  Journal of Scientific Computing, Vol. 68(1), pp. 42-63, (2015).
- Entropy stable schemes for compressible Euler equations.
  D. Ray and P. Chandrashekar.
  Int. J. Numer. Anal. Model. Ser. B, no. 4, p. 335-352 (2013).

Publication in Conference Proceedings

- A Third-Order Entropy Stable Scheme for the Compressible Euler Equations.
  D. Ray.
  In *Theory, Numerics and Applications of Hyperbolic Problems II. HYP 2016. Springer Proceedings in Mathematics and Statistics*, vol 237., 2018
- Kinetic energy preserving and entropy stable finite volume schemes for compressible Euler and Navier-Stokes equations.
  D. Ray and P. Chandrashekar.
  14th Annual CFD Symposium - Aeronautical Society of India, IISc, Bangalore, 10-11 August, 2012.

Submitted for publication

- Non-intrusive reduced order modeling of unsteady flows using artificial neural networks with application to a combustion problem. *(submitted, 2018)*
  Q. Wang, J. S. Hesthaven and D.Ray.
- Multi-level Monte Carlo finite difference methods for fractional conservation laws with random data. *(submitted, 2018)*
  U. Koley, D. Ray and T. Sarkar.

Posters and Talks

Talk: *An artificial neural network as a Troubled-cell Indicator* (10th July, 2018)
SIAM Annual Meeting 2018, Portland

Talk: *An artificial neural network for detecting discontinuities* (11th March, 2018)
7th International Conference on High Performance Scientific Computing, Hanoi

Talk: *A high-resolution energy preserving method for the rotating shallow water equation* (27th September, 2017)
European Conference on Numerical Mathematics and Advanced Applications (ENUMATH-2017), Voss

Talk: *A third order entropy stable scheme for the compressible Euler equations* (4th August, 2016)
XVI International Conference on Hyperbolic Problems (HYP2016), Aachen

Talk: *A sign preserving WENO reconstruction* (23rd November, 2015)
Department of Mathematics, University of Würzburg

Talk: *A sign preserving WENO reconstruction* (14th August, 2015)
International Conference on Industrial and Applied Mathematics, Beijing

Talk: *A sign preserving WENO reconstruction* (11th June, 2015)
Department of Applied Mathematics, University of Washington, Seattle

Talk: *Entropy stable schemes for compressible flows on unstructured meshes* (20th December, 2014)
Conference on Computational PDEs, Finite Element Meet, TIFR-CAM

Talk: *Entropy stable schemes for compressible flows on unstructured meshes* (9th November, 2014)
The 5th International Conference on Scientific Computing and Partial Differential Equations, HKBU, Hong Kong

Poster: *Entropy stable schemes for compressible flows on unstructured meshes* (9th September, 2014)
Workshop on the Analysis and Numerical Approximation of PDEs, ETH Zurich

Talk: *Entropy stable schemes for compressible flows* (9th July, 2014)
Department of Mathematics, University of Würzburg

Teaching Experience

- Teaching Assistant for graduate course on Numerical Methods for Conservation Laws, at EPFL (September - December, 2017)
- Teaching Assistant for graduate course on Computational Partial Differential Equations, at TIFR-CAM (January - May, 2015)
- Teaching Assistant for graduate course on Numerical Analysis, at TIFR-CAM (August - December, 2013)
- Organised numerical sessions for optimal control at the IFCAM Summer School on Numerics and Control of PDEs-2013, at the Indian Institute of Science, Bangalore.
  - Participants were given a crash course on MATLAB coding and ODE-solvers.
  - The models considered were the inverted pendulum, Burgers equation the heat equation in both 1D and 2D set-up.
  - Numerical evaluation of feedback control and solving the estimation problem for noisy partial observations were discussed and implemented.
- Teaching Assistant for graduate course on Numerical Analysis, at TIFR-CAM (August - December, 2012)

Computer Skills

Languages:	C++, Fortran, Python
Proramming Software:	MATLAB
Visualisation Software:	Tecplot, Paraview, Gnuplot, VisIt, Gmsh
Machine-Learning Software:	TensorFlow