Kaushik G Kulkarni

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Education

Aug '17 – *Present*	Ph.D. student in Computer Science *University of Illinois at Urbana-Champaign, Urbana, IL* *Adviser: Prof. Andreas Klöckner*
Aug '13 – May '17	Bachelor of Technology in Mechanical Engineering *Indian Institute of Technology, Bombay* *Adviser: Prof. Shiva Gopalakrishnan*

Experience

May '19 – Aug '19	Givens Associate *Argonne National Laboratory, Illinois* Improved the implementation of Nonlinear optimization algorithms on multi-core systems.
Aug '17 – *Present*	Graduate Research/Teaching Assistant *Computer Science Dept., UIUC*
Jan '16 – May '17	Teaching Assistant for Introduction to Numerical Analysis *Mathematics Dept., IITB*
May '16 – July '16	Software Engineering Intern *Morgan Stanley Strats and Modelling, Mumbai* Developed internal tools to aid cash flow visualizations for traders.

Publications

[1] T. Sun, L. Mitchell, K. Kulkarni, A. Klöckner, D. A. Ham, and P. H. Kelly, *A study of vectorization for matrix-free finite element methods*, 2019.

[2] A. Bhati, R. Sawanni, K. Kulkarni, and R. Bhardwaj, "Role of skin friction drag during flow-induced reconfiguration of a flexible thin plate," *Journal of Fluids and Structures*, vol. 77, pp. 134–150, 2018.

Talks

[1] K. Kulkarni and A. Klöckner, "Transformation-based code optimization for finite element methods," ser. Minisymposium on Performance Portability through Source-to-source code translation, SIAM Conference on Computational Science and Engineering, 2019.

Awards and Achievements

2019	Travel Award for SIAM Conference on Computational Science and Engineering(Spokane, WA)
2016	Undergraduate Research Award(URA01) by Indian Institute of Technology, Bombay
2013	All India Rank of *341* (top 0.01%) in the Joint Entrance Examination - Mains out of 1.5 million students
2013	All India Rank of *419* (top 0.3%)in the Joint Entrance Examination - Advanced out of 0.15 million students
2013	*Kishore Vaigyanik Protsahan Yojana* Fellowship Award
2013	Certificate of Merit for being among the State Top 1% in National Standard examination in Physics and Chemistry

Research

Finite Element Assembly on GPUs

Advised by Prof. Andreas Klöckner, UIUC

Evaluation of Finite Element operators result in a diverse set of computational kernels making it a difficult problem to find one optimization strategy that achieves near-peak performance for all the kernels on GPUs. We are trying to solve this problem by using high level code generation tools that select the optimization strategy based on the loop structure of the kernel.

Abstractions for High Performance Computing

Advised by Prof. Andreas Klöckner, UIUC

Designing a programming abstraction for a high performance system is very critical in determining the performance and maintainability of the final application. We address these issues primarily by taking design decisions in extending `Loopy`[1].

Solving Eikonal Equations on Unstructured Grids

Advised by Prof. S Baskar, IIT Bombay

Characteristic Fast Marching Method is widely used in solving the Eikonal equations, however previous work had been only formulated for structured grids. We developed a solver that extended the algorithm for unstructured grids as well. Used the solver to solve known problems in literature with skew grids so that

[1] `https://documen.tician.de/loopy/`

the activity of the solution could be efficiently observed in the region of activity.
Link: `https://github.com/kaushikcfd/eikonal-unstructured`

Discontinuous Galerkin Framework for Hyperbolic PDEs

Advised by Prof. Shiva Gopalakrishnan, IIT Bombay
We developed a `C++` library for solving Hyperbolic Equations through Discontinuous Galerkin ("DG") methods on structured grids. Performed a series of convergence tests to verify that the framework satisfied $hp-$convergence. Eventually, used the framework to simulate problems in Fluid Dynamics like the dam-break problem using high order DG elements.
Link: `https://github.com/kaushikcfd/Discontinuous-Galerkin`

Flow Induced Reconfiguration of Aquatic Vegetation

Advised by Prof. Rajneesh Bharadwaj, IIT Bombay
Corrected the existing models for Fluid Structure Interaction for a Flexible plate by including the Skin friction coefficient in the computations. Implemented a "*Predictor-Corrector*" based Finite Difference scheme for the computation of coefficient of drag on the plate.
Link: `https://arxiv.org/abs/1712.00441`

Last updated on October 20, 2019