ANAND RADHAKRISHNAN

PERSONAL DATA

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EDUCATION

May'26 (expected) — Georgia Institute of Technology — Program GPA: **4.0/4.0**
Doctor of Philosophy in Computational Science and Engineering

May'21 — University of Illinois at Urbana Champaign — Program GPA: **4.0/4.0**
Master of Science in Mechanical Engineering
With a concentration in Computational Science and Engineering

Aug'19 — Indian Institute of Technology, Bombay — GPA: 9.18/10
Bachelor of Technology in Mechanical Engineering
With a Minor in Computer Science and Honors in Mechanical Engineering

PUBLICATIONS

Sep'20 **A High-Order Accurate Meshless Method for Solution of Incompressible Fluid Flow Problems**
Sahane Shantanu, Radhakrishnan Anand, Vanka Surya Pratap
Journal of Computational Physics

CONFERENCE PRESENTATION

Nov'17 **Subduction at Upper Ocean fronts by Baroclinic Instability**
Verma Vicky; Pham Hieu T; Radhakrishnan Anand; Sarkar Sutanu
Accepted in the American Physical Society Division of Fluid Dynamics (fall'17)

RESEARCH PROJECTS

Oct'21- Jun'22 **GPU Acceleration of Multi-Component Flow Code**
Guide: Prof. S. Bryngelson, Computational Science and Engineering
Georgia Institute of Technology

Ported MFC, a high order-accurate multi-phase compressible flow solver, to GPUs using OpenACC and achieved 300X speedup on 1 NVIDIA V100 compared to 1 Power9 CPU core

Achieved 50% of Peak FLOPS on the most expensive kernel through efficient memory reuse on GPUs

Displayed ideal weak scaling using up to 10,000 GPUs on OLCF Summit

Used CUDA Aware MPI for efficient halo exchange resulting in ideal strong scaling results

May'20- Sep'20 **High-Order Meshless Method for Solution of Incompressible Fluid Flow**
Guide: Prof. S.P. Vanka, Mechanical Engineering
University of Illinois at Urbana Champaign

Discretized the domain using gmsh and applied a high-order accurate cloud based meshfree method that uses Radial-Basis Functions appended with Poly-Harmonic Splines (RBF-PHS) to generate the Poisson operator

Applied the Explicit formulation of the Fractional Step algorithm to advance in time by solving the Pressure Poisson Equation

Used the normal momentum equation to generate the boundary conditions for the pressure solve to maintain high-order accuracy

Factorized the matrix using Reverse Cuthill-Mckee (RCM) ordered Sparse-LU to accelerate the solve time

May'20- Oct'20 **High-Order Meshless Multigrid Method for Solution of Poisson Equation**
Guide: Prof. S.P. Vanka, Mechanical Engineering
University of Illinois at Urbana Champaign

Discretized the domain using gmsh and applied a high-order accurate cloud based meshfree method that uses RBF-PHS on the finest grid to generate the Poisson and Interpolation operators.

Applied Lower-Order RBF-PHS method to generate the corresponding coarse grid operators to improve convergence

Developed an implicit formulation of the Neumann Boundary Equations to accelerate convergence

Used RCM ordered SOR as the relaxation scheme to accelerate the solve time

Jul'18- **Estimation of off-axis Losses in an Inline Pulse Tube Cryocooler**

Apr'19 Guide: Prof. Milind Atrey, Mechanical Engineering

Undergraduate Thesis| Indian Institute of Technology, Bombay

Conducted literature review on how misalignment between gravity and the pulse tube axis leads to Rayleigh-Benard Convection which reduces the cooling power of the cryocooler.

Developed a component level model of the Pulse Tube on ANSYS FLUENT and performed simulations to get the variation of temperature profile with misalignment.

Carried out experiments using an inline pulse tube cryocooler in the Refrigeration and Cryogenics Laboratory at IIT Bombay to corroborate the findings of the simulation.

RESEARCH INTERNSHIP

May'17- **Transport of particles in an Environmental Turbulent flow**

July'17 Guide: Prof. Sutanu Sarkar, Mechanical and Aerospace Engineering, University of California at San Diego

Learned about environmental flows and how density stratification, a ubiquitous characteristic of the ocean, alters the transport of solid particles

Devised numerical algorithms to interpolate the three dimensional velocity field in space and used second order Runge-Kutta to obtain particle trajectories and flow patterns

Quantified various particle statistics for a cloud of particles released on a surface and provided inertia to the tracker particles to analyze the differences in trajectories

Examined the effect of linear and non linear growth of baroclinic instabilities on the subduction process using these trajectories

INTERNSHIP

May'18- **Application of Entropy Based Optimisation on Industrial Heat Equipments**

July'18 Guide: Subramaniam Adhichari

General Electric, John F Welch Technology Centre, Whitefield, Bengaluru,India

Performed multi parameter optimisation of a heat exchanger to be used in jet engines so as to produce minimum entropy generation rate and thus obtained the design parameters

Reviewed the effect of increased surface roughness of additively manufactured components on the heat transfer characteristics such as friction factor and heat transfer coefficient

ACADEMIC PROJECTS

Sep'21- **Investigation of Symmetric AFACy Additive Multigrid Method**
Nov'21 Course: Grad-Studies Computing, Guide: Prof. Edmond Chow

Implemented Symmetric AFACy, a symmetric positive definite multigrain solver which exhibits similar convergence to multiplicative multigrid methods on cartesian grids at a reduced cost

Displayed superior convergence of Symmetric AFACy when compared to other additive multigrain solvers on unstructured grids using Classical Algebraic Multigrid

Aug'19- **Spectral Element Solver for Incompressible Navier-Stokes**
Dec'19 Course: High-Order methods for Fluid Flow, Guide: Prof. Paul Fischer

Implemented a Spectral Method Navier-Stokes Solver for laminar flow past a circular cylinder using Fast-Diagonalization method

Developed a four-element mesh using Salome for a Rayleigh-Taylor problem and used preconditioned conjugate gradients for the spectral element solver using a linear finite element preconditioner

Jan'20- **Integral Equation solver for the exterior Stokes problem**
Apr'20 Course: Numerical Methods for PDE's, Guide: Prof. Andreas Kloeckner

Discretized the domain and the surface density using global fourier series expansion to ensure spectral accuracy in the evaluation of Integrals

Ensured Spectral accuracy by using Gauss Quadrature on the periodic domain along with Interpolation in Fourier space to circumvent the removable singularity in the Double Layer Potential

Applied Kussmaul-Martensen quadrature to evaluate the logarithmic Single Layer Potential
Used GMRES to solve for the surface density and adaptive Gauss quadrature to evaluate the velocities and pressure in the domain

Jul'17- **Navier-Stokes Solver for Incompressible Flow**
Nov'17 Course: Computational Fluid Dynamics, Guide: Prof. Atul Sharma

Developed a Finite Volume based 2D Navier Stokes equations using Semi-Implicit method
Performed grid convergence analysis to optimize mesh refinement for a lid driven cavity
Obtained velocity and pressure contours at steady state for different grid sizes

AWARDS AND ACHIEVEMENTS

2021 Best Paper Award at the International Symposium on Advances in Computational Heal Transfer dedicated to Prof. Spalding

2019 Graduated with a Department Rank of **9** among 156 students

2015 Obtained an All India Rank of **650** in JEE Avanced 2015 out of 150,000 candidates

2015 Secured **99.8** percentile out of 1.3 million students in JEE Main

RELEVANT COURSES

High Performance Computing

Numerical Linear Algebra

Machine Learning

Iterative and Multigrid methods

Heterogenous Parallel Programming

Numerical methods for PDE's

High-Order (Spectral) methods for Fluid Flow

Analytical methods for PDE's

Computational Fluid Dynamics

Data Structures and Algorithms

TEACHING

Aug'20- **Teaching Assistant, ME 310 (Fluid Mechanics)**
Guide: Dr Blake Johnson, UIUC

Jan'20- **Teaching Assistant, ME 412 (Numerical Thermo-Fluids)**
Apr'20 Guide: Prof. S.P. Vanka, UIUC

Aug'19- **Teaching Assistant, ME 320 (Heat Transfer)**
Dec'19 Guide: Dr Blake Johnson, UIUC

Jan'18- **Teaching Assistant, MA 214 (Numerical Analysis)**
Apr'18 Guide: Prof. Rekha Kulkarni, IIT Bombay

TECHNICAL SKILLS

Programming Languages: C++, Fortran, Python, Matlab, Julia, CUDA , OpenACC, MPI

Application Software: ANSYS, AutoCAD, SolidWorks