RAGHAVENDRA NIMIWAL

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EDUCATION

Birla Institute of Technology and Science, Pilani Pilani, India
B.E. (Hons.) Chemical Engineering, (GPA: 8.07/10, Major: 8.42/10) Aug 2015 - Jun 2019

SUMMARY

Currently a research assistant at International Centre for Theoretical Sciences - Tata Institute of Fundamental Research with 3+ years of experience in scientific computing and developing in-house codes for finding approximate solutions to Partial Differential Equations using numerical methods like Finite Difference Methods, Finite Volume Methods, and Finite Element Methods. I see myself as a problem solver hoping to work at an intersection of biology and engineering.

RESEARCH EXPERIENCE

International Center for Theoretical Sciences - TIFR Bangalore, India
Research Assistant under Prof. V. Krishnamurthy June 2020 - Present

- Developing a theoretical model for mechanochemical pattern formation in developing embryos.
  The actomyosin cortex of a cell is considered to be a layer of active fluid (local energy generation and dissipation), where the local concentration of myosin determines the active stress (thus coupling the mechanics with reaction-diffusion). This surface flow is also coupled to the low Reynolds number passive cytoplasmic flow.
- Determining the conditions for pattern forming instabilities in the nonlinear system.
- Using FEniCS (Open source FEM package) to numerically simulate the complete dynamics of the nonlinear system.

International Center for Theoretical Sciences - TIFR Bangalore, India
Visiting Student Fellowship under Prof. M. Kulkarni and Prof. V. Vasan Aug 2019 - May 2020

- Mapped the multicomponent Nonlinear Schrödinger (NLS) equation to the Korteweg-de Vries (KdV) equation
  Chiral reduction of coupled multicomponent NLS system to uncoupled KdV system using Method of Multiple Scales (Reductive Perturbation method).
- Developed a simulation package for multicomponent NLS system which generates soliton (traveling wave packets) like profiles for any arbitrary system using this mapping.
  KdV has special solutions which balance the dispersive and the nonlinear effects in the system to give solitons.
- Implemented Leapfrog, Crank Nicolson, and Runge Kutta 4th order time-stepping schemes in the package (written in C, parallelized using OpenMP) to check the robustness of the generated initial condition.
- Manuscript under preparation for Journal of Physics A: Mathematical and Theoretical.

Institut de Recherche Dupuy de Lome - UMR CNRS 6027 Bretagne, France
Undergraduate Thesis under Prof. M. Arrigoni Jan 2019 - July 2019

- Developed a mathematical model of formation and propagation of blast wave produced by laser dissociation of air.
  A high temperature and pressure zone is created when a pulsed laser is converged at a point.
- Simulated the system numerically using STAR CCM+ and compared the results with the experimental data.
- Engineered a shutter to control the laser pulse using Arduino.
- Developed a MATLAB script to track the wavefront from the high-speed shadowgraphy data.

Indian Institute of Technology, Bombay Mumbai, Maharashtra
Research Internship under Prof. R. Dasgupta May 2018 - July 2018

- Parallelized an in-house Multiphase Flow Solver using Message Passing Interface library functions in C.
  Developed a parallel Multigrid Pressure Poisson equation solver for the in-house code.
- Achieved a speedup of 4 with the parallelization.

Central Salt and Marine Chemicals Research Institute - CSIR Bhavnagar, Gujarat
Research Internship under Prof. R. K. Nagarale May 2017 - July 2017

- Engineered highly selective Polyaniline, Poly-o-anisidine and Polyaniline-co-epichlorohydrin anion exchange membranes for acid recovery by diffusion dialysis.
- Developed a reproducible process for in-situ polymerization of monomers on polypropylene substrate.
- Achieved desired porosity by testing different monomers to achieve high selectivity and acid recovery rate.

ACADEMIC PROJECTS

Numerical solver for boold flow in arteries BITS Pilani

Academic project under Prof. K. B. Joshi Jan 2018 - Dec 2018

- Discretized the Navier-Stokes equations using Finite Volume approach on Staggered Grid in cylindrical coordinates.
- Implemented Fractional-Step time-stepping scheme and Multigrid for Pressure Poisson equation.
- The solver could define solid geometries anywhere inside the domain.
- Implemented Immersed Boundary Method cut cell approach to resolve solid boundaries inside the domain which do not align with the grid lines.

Transient Numerical Model for a Biomass Cookstove BITS Pilani

Academic Project under Prof. P. Sheth Jan 2018 - May 2018

- Modeled reaction kinetics of drying, pyrolysis, and combustion of biomass in convective flows in MATLAB.
- Mass balance, energy balance, and momentum balance were coupled to determine the variation of temperature with height and time in the cookstove, which in turn determined the reaction kinetics in the region.

TECHNICAL SKILLS AND BACKGROUND

Programming Languages: C, Python, Fortran, C++, LaTeX
Parallel Computation: MPI, OpenMP
Softwares and Tools: MATLAB, COMSOL, Solidworks, Ansys Fluent, STAR CCM+
Numerical Methods: Finite Difference Methods, Finite Volume Methods and Finite Element Methods.
Relevant coursework: Calculus, Linear Algebra, Differential Equations, Dynamical Systems, Numerical Methods, Transport Phenomena, Fluid Mechanics, Continuum Mechanics, Heat Transfer, Computer Programming

LEADERSHIP EXPERIENCE

Inspired Karters BAJA BITS Pilani

Design Head and Finance Head Jan 2017 - Dec 2017

- Inspired Karters BAJA is a technical team in BITS Pilani involved in making an off-road vehicle to participate in a pan India student design competition.
- Designed the suspension, wheel assembly and steering of the car, and was responsible for systems integration between steering, suspension, braking, power train and structure teams.
- Performed FEA simulations on all suspension, steering and wheel assembly components using Solidworks.
- Scheduled, maintained manufacturing timelines, and managed finances of 8,00,000 INR for a team of 40 members.

ADDITIONAL EXPERIENCE

1. Attended The Physics of Life Online Summer School 2020 organized by Princeton University
2. Attended ICTP - ICTS Winter School on Quantitative Systems Biology 2019
3. Awarded Long Term Visiting Student Fellowship 2019 at ICTS-TIFR Bangalore

PUBLICATIONS

1. **R. Nimiwal**, U. Satpathi, V. Vasan, M. Kulkarni. Soliton-like behaviour in non-integrable systems. *arXiv:2101.01651*
2. P. K. Prajapati, **R. Nimiwal**, P. S. Singh, R. K. Nagarale. Polyaniline-co-epichlorohydrin nanoporous anion exchange membranes for diffusion dialysis. *Polymer*, 170:168 – 178, 2019
3. P. K. Prajapati, N. N. Reddy, **R. Nimiwal**, P. S. Singh, S. Adimurthy, R. K. Nagarale. Polyaniline@porous polypropylene for efficient separation of acid by diffusion dialysis. *Separation and Purification Technology*, 233:115989, 2020

REFERENCES

1. Dr. Manas Kulkarni, International Center for Theoretical Sciences (Email: manas.kulkarni@icts.res.in)
2. Dr. Vishal Vasan, International Center for Theoretical Sciences (Email: vishal.vasan@icts.res.in)
3. Dr. R. K. Nagarale, Central Salt and Marine Chemicals Research Institute (Email: rknagarale@csmcri.res.in)