Ajit Kumar

Assistant Professor

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Research Interests

Computational Fluid Dynamics, Finite Volume Method, Fluid-Structure Interaction (FSI) problems

Current Research Project

Development and validation of a six-degrees-of-freedom (6dof) motion solver for the CFD code OpenFoam. Salient features:

- Compatible with Overset (Chimera) mesh structure, so high amplitude motions are supported.
- Any number of degrees of freedom can be prescribed and remaining resolved for, so pure rotations or pure translations are supported.
- Tight coupling between fluid and structure solver

Skills

Computer Language	: C++, Matlab, Python
Computational Softwares	: OpenFoam, Paraview, Gmsh, Elmer, Salome, FEniCS
Operating System	: Linux only
Other Useful Toolls	: Git, JeKyll, Julia, Liquid, Mathematica, Scilab, Maxima, Shell

Work Experience

Shiv Nadar University, Greater Noida, India - *Assistant Professor*
June 2011 - PRESENT

University of Houston, Houston, USA - *Teaching/Research Assistant*
August 2005 - May 2011

Education

University of Houston, Houston, USA - *Ph.D. Mathematics* - May 2011

Thesis: *Reduced Models of Networks of Coupled Enzymatic Reactions and Linearization of Michaelis-Menten Differential Equations*

Adviser: Krešimir Josić (www.math.uh.edu/~josic)

University of Houston, Houston, USA - *M.S. Mathematics* - May 2006

St. Stephen's College, Delhi University - *B.A. (Hons) Mathematics* - May 2004

Publications

Journal

1. A. Veliz-Cuba, A. Kumar, and K. Josić. *Piecewise Linear and Boolean Models of Chemical Reaction Networks*. Bulletin of Mathematical Biology 76:29452984 (2014).
2. A. Kumar and K. Josić. *Reduced models of networks of coupled enzymatic reactions.* Journal of Theoretical Biology 278:1, 87-106 (2011)

Conference

1. A. Kumar. *Numerical simulation of cricket ball swings using OpenFOAM*. 17th Annual CFD Symposium, National Aerospace Laboratories, Bangalore (2015)

Under Review

1. A. Kumar. *A mathematical model to maximize information retention by students in college courses.*

Student Supervision

Student Level	Number of Students	Project Information
Ph.D. (Mechanical)	1	Computational study of wind-turbine blades for optimal wind energy harvesting
U.G. (Mechanical)	2	Development and validation of in-house FSI codes
U.G. (Electronics)	1	Modelling and simulation of human population shift as a reverse osmosis process

Conferences & Workshops Participation

1. Computational Fluid Dynamics with OpenFoam, Shiv Nadar University (Organizer, Open for SNU students only, May 2017)
2. 17th Annual CFD Symposium, National Aerospace Laboratories, Bangalore (August 2015)

   Presented Paper: *Numerical simulation of cricket ball swings using OpenFOAM*
3. 16th Annual CFD Symposium, National Aerospace Laboratories, Bangalore (August 2014)
4. 18th National Space Science Symposium, Dibrugarh University, Dibrugarh (January 2014)
5. Ramanujan Mathematical Society, Annual Conference (**Part of core hosting team**, October 2013)
6. Network Biology: Understanding metabolic and protein interactions. MBI, Ohio State University, Columbus, Ohio (September 2009)
7. SIAM Conference on Applications of Dynamical Systems (May 2009)

   Presented Paper: *A Geometric Singular Perturbation Analysis of Signaling Networks*
8. Summer Graduate Program on Applicable Algebraic Geometry at Texas A&M University. Texas A&M University, College Station, Texas, USA (July-Aug 2007)
9. Texas Geometry and Topology Conference, Texas A&M University, College Station, Texas, USA (October 2007)
10. Texas Geometry and Topology Conference, University of Houston, Houston, Texas, USA, (Feb 2006)

Invited Talks

1. *Partial Differential Equations: The backbone of most Engineering Calculations.* Kirorimal College, Delhi University (February 2017)
2. *Partial Differential Equations: The backbone of most Engineering Calculations.* St. Stephen's College, Delhi University (March 2017)

Industry Collaborators

1. ***Global Evolutionary Energy Design*** *(http://www.geedindia.org)*

   Exchange of CFD experience and application in Building Environment Modelling.
2. ***Resistoflex*** (http://www.resistoflex.in)

   Exchange of numerical ODE Solvers and applications in design of Vibration Controlling Systems

Administrative Work

- **Department Seminar Committee** (Chair): Summer 2015 - present
- **Department DST-FIST Committee** (Member): February 2016-present. Overseeing the timely utilization of DST-FIST (http://www.fist-dst.org/) grant.

Teaching Experience

Course	Level	Class Size	Semester
Ordinary Differential Equations	B. Tech. B. Tech. B.S. (Maths) B.S. (Maths) & B. Tech B. Tech. B. Tech. B. Tech	60 195 7 40 150 180 7	Fall 2011 Fall 2013 Spring 2014 Fall 2014 Spring 2016 Spring 2017 Summer 2017
Numerical Analysis	M.S. (Maths) M.S. (Maths) M.S. (Maths)	2 1 1	Fall 2011 Spring 2013 Fall 2013
Optimization	M.S. (Maths)	2	Spring 2012
Linear Algebra	B.S. (Maths) M.S. (Maths & Civil Eng)	7 4	Spring 2012 Fall 2016
Multivariable Calculus	B. Tech. B.S. (Maths) B. Tech. B.S. (Maths) B. Tech. B. Tech. B. Tech. B. Tech. B. Tech.	124 56 70 1 300 250 250 21 250	Fall 2012 Spring 2013 Spring 2014 Fall 2014 Spring 2015 Fall 2015 Fall 2016 Summer 2016 Fall 2017
Partial Differential Equations	BS (Phy & Maths) & B.Tech. BS (Phy & Maths) & B.Tech. BS (Phy & Maths) & B.Tech.	11 17 40	Spring 2015 Spring 2016 Fall 2017
Computational Fluid Dynamics	B. Tech. (Mechanical)	13	Spring 2017