# Dr. Meheboob Alam

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## Education

**Ph.D. in Mechanical Engineering (1998)**: Indian Institute of Science, Bangalore, India. (Advisers: Prof. Prabhu R. Nott and Prof. Vijay H. Arakeri)
**M.S. in Mechanical Engineering (1992)**: Indian Institute of Science, Bangalore, India. (Adviser: Prof. Vijay H. Arakeri)
**B.E. in Mechanical Engineering (1989)**: Bengal Engineering College (now a Deemed University), University of Calcutta, India.

## Awards and Honors

**Head** of the **Max-Planck Partner Group** at JNCASR (2007-2011)
(Awarded by the Max-Planck Society, Germany; Partner Group of MPI for Marine Microbiology, Bremen, in coordination with Prof. A. Khalili)
**Alexander von Humboldt Fellowship (2001.2002)** from the Alexander von Humboldt Foundation, Bonn, Germany.
**Lady Davis Postdoctoral Award (1998)** from Technion Institute of Technology, Haifa, Israel(declined).

## Current Position

**Faculty Fellow** (Assistant Professor) in the '**Engineering Mechanics Unit**' at the **Jawaharlal Nehru Center for Advanced Scienti_c Research**, Bangalore 560064, India. (**From February 2003**).

## Visiting Positions

**Guest Scientist**, Institute for Computer Physics, University of Stuttgart, Pfaffenwaldring 27, D-70569 Stuttgart, Germany
(**1st May 2006 . 31st July 2006**, Funded by the Alexander von Humboldt Foundation, Germany).
**Guest Scientist**, Mathematical Modelling Group, Max Planck Institute for Marine Microbiology, Celciusstrasse 1, D-28359, Bremen, Germany
(**22nd February 2005 . 31st May 2005**, Funded by Max Planck Society, Germany)
**Visiting Researcher**, Particle Technology, DelftChemTech, Delft University of Technology, Julianalaan 136, 2628 BL Delft, The Netherlands

(**14th May 2002 . 30th May 2002**, Funded by the Alexander von Humboldt Foundation, Germany).

# Employment History

**Guest Scientist**, Institute for Computer Physics, University of Stuttgart, Germany (October 2002 . January 2003).
**Alexander von Humboldt Research Fellow**, Institute for Computer Physics, University of Stuttgart, Germany (January 2001- September 2002).
**Postdoctoral Researcher**, Department of Chemical Engineering, University of Colorado, USA (September 1999 . June 2000).
**Postdoctoral Researcher**, Department of Applied Mechanics and Engineering Sciences, University of California San Diego, La Jolla, USA (July 1998 . July 1999).
**Visiting Researcher**, Tata Institute for Fundamental Research, Bangalore 560012, India (March 1998 . April 1998).

# Research Interests

**Particulate and Multiphase Flows:** Kinetic Theory of Dry Granular Media. Stability and Pattern Formation in Particulate Flows. Non-Newtonian Rheology of Particulate Media. Micropolar Theory of complex _uids. Sediment Transport and Porous Media.
**Molecular Dynamics Simulation:** Hard- and Soft-sphere models . Rheology of Granular Flows and Suspensions.
**Fluid Mechanics at Macro- and Nano-scales:** Wall-slip and Rarefied Effects. Suspension of Active Particles.
**Hydrodynamic Stability and Direct Simulation:** Linear and Weakly Nonlinear Analyses of Compressible Flows. Spectra and Pseudo-spectra of Non-normal Operators.

# Research Funding

**Project**: .**Topography Formation and Sediment Transport**. (PI; Co-PI is Prof. A. Khalili)
The MPI-MM (Max Planck Institute for Marine Microbiology, Bremen) and the JNCASR has signed an MOU to set up a *Partner Group* at the JNCASR, called the .**Partner Group for Topography Formation**., with Dr. Alam being the Head of this Group. This Group is funded by the Max Planck Society, Germany (2007-2011)
**Project**: .**Flow Instabilities**. (Co-PI; PI is Prof. R. Narasimha)
Funded by the Defense Research and Development Organization, India (2004-2008)

# Professional Activities

**Reviewer for following Journals**
AIChE Journal, ASME Journal of Applied Mechanics, ASME Journal of Fluid Engineering,
Europhysics Letters, Granular Matter, International Journal of Modern Physics B, Journal of Fluid Mechanics, Physica A, Physics of Fluids, Physics Letters A, Physical Review E, Physical Review Letters, Powder Technology, Pramana: Journal of Physics
**Administrative Activities**
1. Member of the Library Committee at JNCASR (2004- )

2. Member of the Publication Committee at JNCASR (2004- )
3. Organizer of `Fluid Dynamics Colloquium' Series at JNCASR (2003-2006)

# List of Publications

## Journal Articles:

1. Vijayakumar, K.C. & **Alam, M.** (**2007**) Velocity distribution and the effect of wall roughness
in granular Poiseuille _ow. **Physical Review E**, vol. **75**, 051306 (1-5).
2. Gayen, B. & **Alam, M.** (**2006**) Algebraic and exponential instabilities in a sheared micropolar granular _uid. **Journal of Fluid Mechanics**, vol. **567**, p. 195-233.
3. **Alam, M.**, Trujillo, L. & Herrmann, H. J. (**2006**) Hydrodynamic theory for reverse Brazil-nut segregation and the non-monotonic ascension dynamics. **Journal of Statistical Physics**, vol. **124**, p. 587-623
4. Montanero, J., Garzo, V., **Alam, M.**&Luding, S. (**2006**) Rheology of two- and three-dimensional granular mixtures under uniform shear _ow: Enskog kinetic theory versus molecular dynamics simulations. **Granular Matter**, vol. **8**, p. 103-115.
5. **Alam, M.** (**2006**) Streamwise structures and density patterns in rapid granular Couette _ow. **Journal of Fluid Mechanics**, vol. **553**, p. 1-32.
6. Malik, M., **Alam, M.** & Dey, J. (**2006**) Nonmodal energy growth and optimal perturbations in compressible Couette _ow. **Physics of Fluids**, vol. **18**, p. 034103 (1-14)
7. **Alam, M.** & Luding, S. (**2005**) Energy nonequipartition, rheology and microstructure in sheared bidisperse granular mixtures. **Physics of Fluids**, vol. **17**, p. 063303 (1-18)
8. **Alam, M.**, Arakeri, V.H., Nott, P.R. and Herrmann, H.J. (**2005**) Instability-induced ordering, universal unfolding and the role of gravity in granular Couette _ow. **Journal of Fluid Mechanics**, vol. **523**, p. 277-306.
9. Trujillo, L., **Alam, M.** & Herrmann, H.J. (**2003**) Segregation in a _uidized binary granular mixture: Competition between buoyancy and geometric forces. **Europhysics Letters**, vol. **64**, p. 190-196.
10. **Alam, M.** & Luding, S. (**2003**) First normal stress difference and crystallization in a dense sheared granular _uid. **Physics of Fluids**, vol. **15**(August), p. 2298-2312.
11. **Alam, M.** & Luding, S. (**2003**) Rheology of bidisperse granular mixtures via event-driven simulations. **Journal of Fluid Mechanics**, vol. **476**, p. 69-103.
12. **Alam, M.** & Luding, S. (**2002**) How good is the equipartition assumption for the transport properties of a granular mixture? **Granular Matter**, vol. **4**, p. 137-142.
13. **Alam, M.**, Willits, J., Arnarson, B. & Luding, S. (**2002**) Kinetic theory for a binary mixture of nearly elastic disks with size and mass disparity. **Physics of Fluids**, vol. **14**(November), p. 4085-4087.
14. **Alam, M.** & Herenya, C. (**2001**) Inelastic collapse in simple shear _ow of a granular medium. **Physical Review E**, vol. **63**, p. 061308 (1.8).
15. Godard, J. & **Alam, M.** (**1999**) Shear-_ow and material instabilities in particulate suspensions and granular media. **Particulate Science and Technology**, vol. **17**, p. 69-96.
16. Nott, P.R., **Alam, M.**, Agrawal, K., Jackson, R. & Sundaresan, S. (**1999**) The effect of boundaries on plane Couette _ow of granular materials: a bifurcation analysis. **Journal of Fluid Mechanics**, vol. **397**, p. 203-229.
17. **Alam, M.** & Nott, P.R. (**1998**) Stability of plane Couette _ow of a granular material. **Journal of Fluid Mechanics**, vol. **377**, p. 99-136.

18. **Alam, M.** & Nott, P.R. (**1997**) The in_uence of friction on the stability of unbounded granular shear _ow. **Journal of Fluid Mechanics**, vol. **343**, p. 267-301.
19. **Alam, M.** & Arakeri, V.H. (**1993**) Observations on transition in plane bubble plumes. **Journal of Fluid Mechanics**, vol. **254**, p. 363-375.

## Preprints:

1. **Alam, M.** & Khalili, A. (**2007**) Instabilities and pattern in horizontally oscillating particle-_uid mixture. *Preprint* (*submitted*)
2. Malik, M., Dey, J., & **Alam, M.** (**2007**) Effects of viscosity model on linear stability and transient growth in compressible plane Couette _ow. *Preprint* (*submitted*)
3. Gayen, B. & **Alam, M.** (2007) Orientational correlation and velocity distributions in uniform shear _ow of a dilute granular gas. *Preprint (submitted)*
4. Lakkaraju, R. & **Alam, M.** (2007) Effects of Prandtl number and a new instability mode in a plane thermal plume. *Preprint (submitted)*
5. Vijayakumar, K. C. & **Alam, M.** (2007) Slip velocity, stresses and density-waves in granular Poiseuille _ow. (*Preprint*)
6. Shukla, P. & **Alam, M.** (2007) Nonlinear stability of granular shear _ow: Landau equation and shearbanding. (*In preparation*)
7. **Alam, M.** (2007) Instability-induced rotational driving, transient energy growth and optimal perturbations in a sheared micropolar granular _uid. (*In preparation*)

## Books:

1. **Advances in Fluid Mechanics**
Editors: **M. Alam**, R. Govindarajan, O. Ramesh, & K. Sreenivas (2003)
JNCASR, Bangalore 560064 (Proceedings of the Symposium in Honour of Prof. R. Narasimha's 70th Birthday.)

## Conference Proceedings:

1. Shukla, P. & **Alam, M.** (2007) Nonlinear stability of granular plane Couette _ow: Landau equation and shearbanding. **EUROMECH492: Shearbanding Phenomena in Entangled Systems**, 3-5 September 2007, University College London, London, UK.
2. **Alam, M.** & Shukla, P. (2007) An exact order-parameter description of granular plane Couette_ow from nonlinear stability analysis: Landau equation. **Traf_c and Granular Flow 2007**, 20-22 June 2007, University of Paris-Sud, Orsay, France.
3. **Alam, M.** & Khalili, A. (2007) Mean _ow and linear stability of an oscillatory suspension. **Proceedings of 2 Intl Conf on Porous Media and its Applications in Science, Engineering and Industry**, 17-21 June 2007, Kauai, Hawaii, USA, p. 1-6.
4. **Alam, M.** (2006) Hydrodynamic model for reverse segregation in _uidized granular mixtures with convection. **Symposium on Trends in Applications of Mathematics to Mechanics** (STAMM06), 10-14 July 2006, Technishe Universit¨atWien, Vienna, Austria.
5. Malik, M., Dey, J. & **Alam, M.** (2006) Transient growth, optimal perturbations and energy budget in compressible Couette _ow. **Proceedings of XI Asian Congress of Fluid Mechanics**, (22-25 May 2006, Kuala Lumpur, Malaysia), p. 1-6 (CD-ROM).
6. **Alam, M.** & Luding, S. (2005) Non-Newtonian Granular Fluid: Simulation and Theory. **Powders and Grains 2005** (Editors: R. Garcia-Rojo, H. J. Herrmann and S.

McNamara), pp. 1141-1145, A. A. Balkema, Leiden, Netherlands. (Proceedings of the Fifth `Powders and Grains' International Conference, 18-22 July 2005, Stuttgart, Germany).
7. **Alam, M.** (2005) Universal unfolding of pitchfork bifurcation and shearband formation in rapid granular Couette _ow. **Trends in Applications of Mathematics to Mechanics** (Editors: Y. Wang and K. Hutter), pp. 11-20, Shaker Verlag, Aachen, Germany. (Proceedings of STAMM04, 22-28 August, Seeheim-Jugenheim, Germany).
8. Arakeri, V.H., Pal, A., Goswami, S. & **Alam, M.** (2004) Observations on bubble driven plane laminar _ows. **Proceedings of the Tenth Asian Congress of Fluid Mechanics**, (17-21 May, Peradeniya, Sri Lanka), p. 1-4 (CD-ROM).
9. **Alam, M.** (2003) Pattern formation in rapid-shear granular Couette _ow. **Proceedings of the Symposium on Advances in Fluid Mechanics**, (Editors: M. Alam et al.), JNCASR, Bangalore, India, p. 150-160.
10. **Alam, M.**, Cleland, R. & Herenya, C. (2000) Effect of polydispersity on stresses in granular shear _ow. **Proceedings of Material Research Society Symposium Series**. (Editors: S. Sen, M. Hunt & F. van Swol) vol. **627**, p. 247-252.
11. **Alam, M.** & Arakeri, V.H. (1993) Observations on interaction of laminar bubble plumes. **ASME Cavitation and Multiphase Flow Forum: FED**, vol. **153**, p. 63-65.