

Jonathan Philip Rothstein

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Summary Mechanical engineer with experience in experimental and theoretical fluid dynamics, heat transfer, hydrodynamic stability, rheology of complex fluids, optical measurement techniques, polymer processing and computational techniques.

Education

Massachusetts Institute of Technology
Doctor of Philosophy in Mechanical Engineering

Cambridge, MA
expected 06/2001

Harvard University
Masters of Science in Engineering and Applied Science

Cambridge, MA
received 03/1998

The Cooper Union for the Advancement of Science and Art
Bachelor of Engineering in Mechanical Engineering

Manhattan, NY
received 05/1996

Professional Experience

- 1999-2000** **Polaroid Corporation** **Waltham, MA**
Worked as a consultant. Responsible for the full rheological characterization of several polymer melts and dyes along with the detailed presentation and analysis of the results
- 1999** **Nashua Corporation** **Nashua, NH**
Worked as a consultant. Aided in the design of a high speed, thin film, paper coating process.
- 1996, 1993-4** **Exa Corporation** **Lexington, MA**
Held internship for two summers as an engineer assistant and one summer as a design engineer for the physics group of a computational fluid dynamics corporation. Responsible for development and application of lattice Boltzman CFD simulations, detailed analysis of the results, error diagnosis and coding. Was able to obtain good agreement with experiments for many flow geometries including backsteps, airfoils and automobiles.
- 1995** **Northrop Grumman** **Bethpage, NY**
Held summer internship with the B-2 Division of Northrop Grumman's Advanced Technology and Development Center. Responsible for the design of and the subsequent low speed fluid dynamic testing of various Lift Improvement Devices (LID) on the Marine Vertical/Short Take-Off and Landing (V/STOL) application of several Joint Advanced Strike Technology (JAST) competition entries. Devised a simple pattern of LIDs utilizing the aircrafts flaps and doors which greatly increased the lift generated by the engines without compromising the aircraft's stealth.

Research Experience

- 1998-Present** **Massachusetts Institute of Technology** **Cambridge, MA**
Ph.D. Thesis Title: "The Flow of Elastic Fluids Through Axisymmetric Abrupt Contraction-Expansions"
Research assistant supported by a grant from NASA Glenn Microgravity Research Center. Performed a detailed experimental, theoretical and numerical investigation into the behavior of non-Newtonian fluids in complex flows containing regions of both shear and extension. Designed and built an experimental apparatus to characterize the flow of an ideal elastic polymer solution through an axisymmetric contraction-expansion. Utilized pressure drop measurements and flow measurement techniques such as Particle Image Velocimetry (PIV), Laser Doppler Velocimetry (LDV) to capture the macroscopic flow properties. Developed an axisymmetric Flow Induced Birefringence (FIB) system capable of measuring average molecular conformations of the polymer chains throughout the flow field. These results constitute a comprehensive experimental data set which is a demanding comparative tool for both numerical simulations and constitutive models. Devised a methodology to explain the presence or absence of the elastic 'lip' vortex observed upstream of the contraction plane for different polymeric fluids and contraction ratios by generating a ratio which compares the importance of the normal stresses observed in simple shear to those observed in transient

uniaxial extension. Investigated the stability of polymeric fluids in non-isothermal torsional flows. Introduced a new dimensionless thermoelastic number to describe the importance of viscous heating in the suppression of elastic flow instabilities at high shear rates.

- 1997-1998 Harvard University Cambridge, MA**
Research assistant studying of the behavior of self-assembling, wormlike micelle solutions in torsional flows. Used flow visualization and stress measurements to characterized an elastic flow instability.
- 1997-1998 The Cooper Union New York, NY**
As an undergraduate research assistant, performed a wind tunnel study of the aerodynamic properties of an Acheulean hand axe to determine whether the Neanderthal's axe could have been used as a projectile weapon.

Honors and Awards

Division of Engineering and Applied Science Graduate Fellowship (1996-1997)
Four year full tuition scholarship to The Cooper Union (1992-1996)
Graduated Summa Cum Laude (1996)
Received honorable mention for a National Science Foundation Fellowship (1996)

Skills

Scientific: An excellent knowledge of experimental techniques and equipment including, but not limited to:

- Particle Image Velocimetry (PIV)
- Laser Doppler Velocimetry (LDV)
- Flow Induced Birefringence (FIB)
- filament stretching rheology and various shear rheology techniques

An extensive knowledge of pressure and force transducers, data acquisition hardware and software, motors, drivers and controllers. Limited experience with other optical measurement techniques such as interferometry and Laser Induce Fluorescence (LIF). Director of MIT ME graduate student machine shop.

Computer: Extensive experience with Unix and Windows based operating systems and computers. Proficient in C/C++, Labview and MATLAB. Made considerable use of Microsoft and Corel office suites as well as AutoCAD, ProEngineer, and Solid Works drafting packages. Excellent knowledge of computer hardware including data acquisition boards, frame grabbers and programable controllers.

Referee to Scientific Journals: Reviewer for Journal of Non-Newtonian Fluid Mechanics and Physics of Fluids.

Affiliations

President of Cooper Union's NY Iota Chapter of the Engineering Honor Society Tau Beta Pi (1995-1996).
Member of ASME (joined 1994), Society of Rheology (joined 1996) and AIChE (joined 1998)

Publications

J.P. Rothstein and G.H. McKinley. *Extensional flow of a polystyrene Boger fluid through a 4:1:4 axisymmetric contraction-expansion*, J. Non-Newtonian Fluid Mech., **86** (1999) 61-88.

J.P. Rothstein and G.H. McKinley. *Non-isothermal modification of purely elastic flow instabilities in torsional flows of polymeric fluids*, Phys. Fluids, In Press (2000)

J.P. Rothstein and G.H. McKinley. *Axisymmetric flow-induced birefringence measurements for the flow of a polystyrene Boger fluid into an abrupt contraction-expansion*, Proceedings of the XIIIth International Congress on Rheology, (2000)

J.P. Rothstein and G.H. McKinley. *The axisymmetric contraction-expansion: The role of extensional rheology on vortex growth dynamics and the enhanced pressure drop*, J. Non-Newtonian Fluid Mech., Submitted (2000)

Conference Presentations

Have presented work at five conferences worldwide.

References available upon request