

Ram V. Mohan, Ph.D.
Associate Professor, Nanoengineering
Joint School of Nanoscience and Nanoengineering

Research Interests

- Computational multi-physics/multi-scale modeling and simulation in engineering and physical applications
- Computational mechanics, nanomechanics, and material sciences
- Processing, mechanics, characterization, and computational modeling of composite and nanoengineered material systems (crystalline, amorphous, cementitious, and bio material systems and their multi-scale effects)
- Computational modeling of bio and nano systems, interfaces and interactions
- Transport phenomena; Flow and thermal behavior during composite material processing and in fibrous porous media
- Physics based composite process modeling simulations, process optimization with experimental investigations by resin transfer molding (RTM), vacuum assisted resin transfer molding (VARTM) and liquid composite molding (LCM) processes
- High-Performance, scalable scientific computing and engineering product visualization
- Engineering education

Education

University of Minnesota	Mechanical Engineering	Ph.D., 1997
University of Illinois at Urbana-Champaign	Theoretical and Applied Mechanics	M.S., 1990
West Virginia University	Mechanical Engineering	M.S.M.E, 1987
University of Madras, India	Mechanical Engineering	B.Engg. 1985

Experience

Associate Professor and Graduate Program Coordinator, Computational Science and Engineering, NC A&T State University
Senior Research Scientist, Center for Advanced Materials and Smart Structures, North Carolina A&T State University, 8/2003-11/2006
Assistant Research Professor, Department of Mechanical Engineering, University of New Orleans, 9/2001-8/2003
Composites Materials Expert, NASA National Center for Advanced Manufacturing, 9/2001-8/2003
Resident Scientist, U. S. Army Research Laboratory, 7/1994-9/2001
Research Scientist, University of Minnesota, 3/1998-9/2001
Research Assistant, Army High Performance Computing Research Center, University of Minnesota

Selected Publications

Computational Nanoengineering, nanomechanics; nanoengineered materials

1. R. Mohan, Y. Purohit, Y. Liang, "Deformation Behavior of Nanoscale Material Systems with Applications to Tensile, Flexural and Crack Propagation," *Journal of Computational and Theoretical Nanoscience*, (*accepted, in print*) 2011.
2. Molecular Dynamics of Crack Propagation in Nickel and Nickel-Aluminum Bimetal Interface, IMECE2010-38677, ASME Congress, 2010. (Y. Purohit and R. Mohan).
3. E. Fefey, R. Mohan, and A. Kelkar, "Effect of Vacancy Defects on the Young's Modulus of a SWCNT – MD Simulations", *Materials Science and Engineering – Part B*, Vol. 176, pp. 693-700, 2011.
4. Molecular Dynamics Simulations and Analysis of Material Interactions in Alumina Particulate Hybrid Composites, AIAA-2008-2097, 2008 AIAA Structural Dynamics and Materials Conference, April 2008. (R. Mohan, O. Akinyede, A. Kelkar and J. Sankar).
5. R. Mohan, O. Akinyede, A. Kelkar, and J. Sankar, "Processing, Evaluation and Molecular Simulations in Hybrid Fiber Polymer Composites with Alumina Nanoparticles," *Developments in Nanocomposites*, Research Publishing Services, Singapore, ISBN 978-981-08-3711-2, 2010.
6. A. Kelkar, R. Mohan, R. Bolick, and S. Shendokar, "Effect of Nanoparticles and Nanofibers on Mode I Fracture Toughness of Fiber Glass Reinforced Polymer Matrix Composites", *Materials Science and Engineering – Part B*, Vol. 168, 2010.
7. O. Akinyede, R. Mohan, A. Kelkar, J. Sankar, "Static and Fatigue Behavior of Epoxy/Fiberglass Composites Hybridized with Alumina Nanoparticles," *Journal of Composite Materials*, Vol. 43, No. 7, pp. 769-781, 2009.
8. A. Kelkar, R. Mohan, R. Bolick, and S. Shendokar, "Effect Of Electrospun Fibers on the Interlaminar Properties of Woven Composites," *Advanced Materials Research* Vols. 47-50 (2008), pp: 1031-1034.
9. S. Desai, R. Mohan, J. Sankar, T. Tiano, "Understanding Conductivity in a Composite Resin with Single Wall Carbon Nanotubes (SWCNTs) using Design of Experiments," *Int. J. Nanomanufacturing*, Vol. 2, No. 4, pp. 292-304, 2008.

Computational Composite Process Modeling and Experimental Investigations

10. B. Henz, R. Mohan, D. Shires, "A Hybrid Global Local Approach for Optimization of Injection Gate Locations in Liquid Composite Molding Process Simulations," *Composites: Part A*, Vol. 38, pp. 1932-1946, 2007.
11. N. Yamaaleev and R. Mohan, "Effect of Phase Transition on Intra-Tow Flow Behavior and Void Formation in Liquid Composite Molding," *Int. J. Multiphase Flow*, V. 32, pp. 1219-1233, 2006.

12. B. Henz, R. Mohan, N. Ngo, P. Chung, K. Tamma, "Process Modeling of Composites by Resin Transfer Molding: Sensitivity Analysis for Non-Isothermal Considerations," *International Journal of Numerical Methods for Fluid Flow*, Vol. 15, No. 7, 2005.
13. M. Allende, R. Mohan, S. Walsh, "Experimental and Numerical Analysis of Flow Behavior in the FASTRAC Liquid Composite Manufacturing Process," *Polymer Composites*, Vol. 25, No. 4, pp. 384 – 396, August 2004.
14. S. Walsh and R. Mohan, "Sensor-Based Control of Flow Fronts in Vacuum-Assisted RTM," *Plastics Engineering*, Vol. LV, No. 10, 1999.
15. R. Mohan, N. Ngo and K. Tamma, "On a Pure Finite Element Methodology for Resin Transfer Mold Filling Simulations," *Polymer Engineering and Science*, Volume 39, No. 1, pp. 26 - 43, January 1999.
16. S. Bickerton, R. Mohan, S. Advani and D. Shires, "Experimental Analysis and Numerical Modeling of Flow Channel Effects in Resin Transfer Molding," *Polymer Composites*, Vol. 21, No. 1, 2000.
17. R. Mohan, D. Shires, K. Tamma and N. Ngo, "Flow Channels and Fiber Impregnation Studies for the Process Modeling/Analysis of Complex Engineering Structures Manufactured by Resin Transfer Molding," *Polymer Composites*, Vol. 19, No. 5, pp. 527 – 542, October 1998.
18. N. Ngo, R. Mohan, P. Chung, K. Tamma and D. Shires, "Recent Developments Encompassing Non-Isothermal/Isothermal Liquid Composite Molding Process Modeling/Analysis: Physically Accurate, Computationally Effective and Affordable Simulations and Validations," *Journal of Thermoplastic Composites - Special Issue on Affordable Composites*, Volume 11, pp. 493 - 532, November, 1998.
19. R. Mohan, N. Ngo, K. Tamma, D. Shires, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Implicit Tracking of Moving Fronts for Thick, Geometrically Complex Composites Manufacturing Applications - Part 2," *Numerical Heat Transfer - Part A, Applications*, Vol. 35, no. 8, pp. 839 - 858, 1999.
20. R. Mohan, N. Ngo and K. Tamma, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Explicit Tracking of Moving Fronts for Developments for Thick, Geometrically Complex Composites Manufacturing Applications - Part 1," *Numerical Heat Transfer - Part A, Applications*, Vol. 35, no. 8, pp. 815 - 838, 1999.

High Performance Computing and Computational Analysis

21. B. Henz, D. Shires, R. Mohan, "Development and Integration of Parallel Multi-Disciplinary Computational Software for Modeling a Modern Manufacturing Process," *Lecture Notes in Computer Science*, Vol. 3402, Springer Verlag, April 2005.
22. D. Shires and R. Mohan, "Optimization and Performance of a FORTRAN 90 MPI – Based Unstructured Code on Large Scale Parallel Systems," *Journal of Supercomputing*, Vol. 25, pp. 131 – 141, 2003.
23. D. Shires, R. Mohan, "An Evaluation of HPF and MPI Approaches and Performance in Unstructured Finite Element Simulations," *Journal of Mathematical Modeling and Algorithms*, Vol. 1, pp. 153 – 167, 2002.

24. R. Mohan, D. Shires, A. Mark and K. Tamma, "Advanced Manufacturing of Large Scale Composite Structures: Process Modeling, Manufacturing Simulations and Massively Parallel Computing Platforms," *Advances in Engineering Software*, Volume 29, No. 3 - 6, pp. 249 - 264, Elsevier, UK, 1998.

Computational Mechanics

25. W. Poon, R. Kanapady, R. Mohan, and K. Tamma, "Multi-Disciplinary Flow/Thermal and Induced Stresses in Convectively Cooled Structures," *J. of Thermal Stresses*, Vol. 25, pp. 319 – 339, 2002.
26. R. Mohan, A. Avila and K. Tamma, "Flux-Based Finite Volume Formulations and Adaptive Time Stepping Strategies for Modeling of Re-entry Thermal Protection Systems," *Numerical Heat Transfer - Part B*, Vol. 30, no. 2, pp. 117 - 136, 1996.
27. R. Mohan, A. Avila, K. Tamma and R. Namburu, "Three-Dimensional Transient Thermal Analysis with Explicit Finite Element Representations - Parallel Implementations and Performance Studies: The Connection Machine (CM-5)," *Numerical Heat Transfer - Part B*, Vol. 28, pp. 277 - 291, 1995.
28. Y. Mei, R. Mohan and K. Tamma, "Evaluation and Applicability of a New Explicit Time Integral Methodology for Transient Thermal Problems - Finite Volume Formulations," *Numerical Heat Transfer - Part B*, Vol. 26, pp. 313 - 333, 1994.
29. X. Chen, R. Mohan and K. Tamma, "Instantaneous Response of Elastic Thin-Walled Structures to Rapid Heating," *International Journal for Numerical Methods in Engineering*, Vol. 37, pp. 2389 - 2408, 1994.
30. R. Mohan and K. Tamma, "Finite Element/Finite Volume Approaches with Adaptive Time Stepping Strategies for Transient Thermal Problems," *Sadhana - Academy Proceedings in Engineering Sciences*, Vol. 19, part 5, pp. 765 - 783, 1994.

Research Funding

- Nano to Continuum Multi-Scale Modeling Techniques and Analysis for Cementitious Materials under Dynamic Loading, Partnership in Research Transition Program, Army Research Office, Ram Mohan (PI)
- Computational Modeling and HPC in Advanced Materials Processing, Synthesis and Design, Office of Naval Research, Ram Mohan (PI)
- Integrating NASA Science, Technology and Research in Undergraduate Curriculum and Training (INSTRUCT), NASA, Ram Mohan (Co-PI)
- (2001- current) Sustained prior funding from Department of Defense and industries in the research interest areas (Ram Mohan, PI and Co-PI)