

## Curriculum Vitae for Rao V. Garimella

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### Career Objective:

Research and develop tools for solution of challenging computational physics problems.

### Research Interests:

Unstructured Mesh Generation, Geometric Modeling, Computational Geometry, Finite Element Methods, Finite Volume Methods and Numerical Optimization.

### Education:

Ph.D., Mechanical Engineering, 1998, Rensselaer Polytechnic Institute, Troy, NY.  
(Thesis: Anisotropic Tetrahedral Mesh Generation).

MS, Mechanical Engineering, 1992, Ohio University, Athens, OH.  
(Thesis: Kinematic Analysis of Free-floating Mechanisms).

BS, Mechanical Engineering, 1989, S J College of Engineering, Mysore, India.

### Employment:

*Staff Scientist, T-7, Los Alamos National Laboratories. (06/01 - Present)*

*Postdoctoral Research Associate, T-7, Los Alamos National Laboratories. (06/01 - 06/02)*

Developing methods for unstructured mesh adaptation and quality improvement in ALE (Arbitrary Lagrangian-Eulerian) simulations of gas dynamics problems. Research includes:

- Strategies for mesh reconnection in unstructured polygonal meshes
- Quality improvement of surface meshes by node repositioning using local parameterization
- Quality improvement of solid meshes with polyhedral elements
- Methods for untangling unstructured meshes in 2D and 3D

Developing MSTK (MeSh ToolKit) for flexible infrastructure for representing and manipulating unstructured meshes. Current development efforts include:

- Developing AMR (Adaptive Mesh Refinement) infrastructure
- Research methods for using compressed storage of dynamic meshes

*Postdoctoral Research Associate, EES-6, Los Alamos National Laboratories. (06/99 - 06/01)*

Researched and developed methods for geometric modeling, mesh generation and finite volume simulation of subsurface porous flow and transport problems.

***Postdoctoral Research Fellow, Scientific Computation Research Center, Rensselaer Polytechnic Institute. (01/99 - 06/99)***

***Research Assistant, Scientific Computation Research Center, Rensselaer Polytechnic Institute. (05/93 - 01/99)***

Developed and/or supported research projects for sponsors including Ford, Pratt & Whitney, GE, Howmet Corp, PCC Airfoils, EDS/Unigraphics, MSC, Wright-Patterson AFB, Centric Engineering Systems and Simmetrix Inc.

Developed algorithms and large scale software for Automatic Mesh Generation, including

- Automatic boundary layer mesh generation for viscous flow simulations involving complex geometric domains such as cars with complete under-the-hood and under-the-body detail.
- Automatic generation of tetrahedral meshes with multiple elements through the thickness for complex biomechanics and casting simulations.
- Unstructured mesh quality improvement by local mesh modifications.

Also developed software for Automatic Model Generation, Geometric Modeling, Computational Geometry, Finite element pre- and post-processing and simple Finite Element Analyses.

***Teaching Assistant, Mechanical Engineering, Rensselaer Polytechnic Institute. (08/92 - 05/93)***

***Research Assistant, Mechanical Engineering, Ohio University. (01/90 - 07/92)***

Investigated the kinematics, inverse kinematics and path planning algorithms for a free-floating mechanism (Research supported by National Science Foundation grant).

***Teaching Assistant, Mechanical Engineering, Ohio University. (01/91 - 04/91)***

***Project Engineer, Aerospace Engineering, Indian Institute of Science, India. (01/90 - 06/90)***

## **Publications:**

- [1] P. Vachal, R. V. Garimella, and M. J. Shashkov. Untangling of 2d meshes in ale simulations. *Journal of Computational Physics*, to appear 2004.
- [2] R. V. Garimella, M. J. Shashkov, and P. M. Knupp. Triangular and quadrilateral surface mesh quality optimization using local parametrization. *Computer Methods in Applied Mechanics and Engineering*, 193(9-11):913–928, Mar 2004.
- [3] R. V. Garimella and B. K. Swartz. Curvature estimation for unstructured triangulations of surfaces. Technical Report LA-UR-03-8240, Los Alamos National Laboratory, Nov 2003.
- [4] R. V. Garimella. Mesh data structure selection for mesh generation and FEA applications. *International Journal of Numerical Methods in Engineering*, 55(4):451–478, Oct 2002.
- [5] R. V. Garimella, M. J. Shashkov, and P. M. Knupp. Optimization of surface mesh quality using local parameterization. In *Proceedings of the Eleventh International Meshing Roundtable*, pages 41–52, Ithaca, NY, Sep 2002. Sandia National Laboratories.

- [6] R. V. Garimella. Quality improvement of surface triangulations using local parameterization. In *Proceedings of the 8th International Conference on Grid Generation in Computational Field Simulations*, pages 609–618, Honolulu, HI, Jun 2002.
- [7] R. V. Garimella and M. S. Shephard. Boundary layer mesh generation for viscous flow simulations. *International Journal of Numerical Methods in Engineering*, 49(1-2):193–218, Sep 2000.
- [8] R. V. Garimella and M. S. Shephard. Generation of tetrahedral meshes with multiple elements through the thickness. *Engineering with Computers*, 15(2):181–197, 1999.
- [9] B. K. Karamete, R. Garimella, and M. S. Shephard. Recovery of an arbitrary edge on an existing surface mesh using local mesh modifications. *International Journal for Numerical Methods in Engineering*, 50(6):1389–1409, Feb 2001.
- [10] R. V. Garimella. *Anisotropic Tetrahedral Mesh Generation*. PhD thesis, Rensselaer Polytechnic Institute, Troy, NY 12180, Dec 1998.
- [11] R. Garimella and M. S. Shephard. Boundary layer meshing for viscous flows in complex domains. In *Proceedings of the Seventh International Meshing Roundtable*, pages 107–118, Dearborn, MI, Oct 1998. Sandia National Laboratories. Sandia Report SAND 98-2250.
- [12] R. V. Garimella, B. E. Webster, and Shephard M. S. Automatic mesh generation of complex configurations including viscous boundary layers. In *Proceedings of the 10th International Conference on Finite Elements in Fluids*, pages 369–374, University of Arizona, Tucson AZ, Jan 1998.
- [13] S. K. Agrawal, R. Garimella, and G. Desmier. Free-floating closed-chain planar robots: kinematics and path planning. *Nonlinear Dynamics*, 9(1-2):1–19, Feb 1996.
- [14] M. S. Shephard, M. W. Beall, R. Garimella, and R. Wentorf. Automatic construction of 3-D models in multiple scale analysis. *Computational Mechanics*, 17(3):196–207, Dec 1995.
- [15] R. Garimella and M. S. Shephard. Tetrahedral mesh generation with multiple elements through the thickness. In *Proceedings of 4th Annual International Meshing Roundtable Conference*, pages 321–334, Albuquerque, NM, Oct 1995. Sandia National Laboratories. Sandia Report SAND 95-2130.
- [16] S. K. Agrawal and R. Garimella. Kinematics, workspace and design of a dual-arm spatial robot in zero-gravity. *Journal of Mechanical Design*, 116(3):901–907, Sep 1994.
- [17] S. K. Agrawal and R. Garimella. Workspace boundaries of free-floating open and closed chain planar manipulators. *Journal of Mechanical Design*, 116(1):105–110, Mar 1994.
- [18] M. S. Shephard, T.-L. Sham, L.-Y. Song, V. S. Wong, R. Garimella, and et. al. Global/local analyses of multichip modules: Automated 3-d model construction and adaptive finite element analysis. In *Advances in Electronic Packaging 1993*, volume 1, pages 39–49. American Society of Mechanical Engineers, Sep 1993.
- [19] S. K. Agrawal and Garimella R. Path planning algorithm for a free-floating closed-chain planar manipulator. In *Flexible Mechanisms, Dynamics, and Analysis – Proceedings of the 22nd Biennial Mechanisms Conference*, volume 47, pages 645–652, Scottsdale, AZ, Sep 1992. ASME Design Engineering Division, ASME.

- [20] S. K. Agrawal and R. Garimella. Inverse kinematic solutions of free-floating closed-chain planar manipulators. In *Advances in Design Automation – Proceedings of the 17th Design Automation Conference*, volume 32, pages 551–556, Miami, FL, Sep 1991. ASME Design Engineering Division, ASME.
- [21] S. K. Agrawal, R. Garimella, and G. Desmier. Optimal workspace designs of free-floating planar manipulators. In *Proceedings of IEEE/RSJ International Workshop on Intelligent Robots and Systems '91*, Osaka, Japan, Nov 1991. IEEE.

### **Awards and Honors:**

- Finalist (among 60 candidates) for Wilkinson Fellowship, awarded by the Math and Computational Sciences Division, Argonne National Laboratories, Chicago, IL.
- Letter of Commendation (copy to Dean of Engineering, Rensselaer) from Mr. Andrew Jay, Casting Discipline Chief, Pratt & Whitney, Hartford, CT for work on ICCA project.
- Best Poster, 7th International Meshing Roundtable organized by Sandia National Laboratories, Dearborn, MI, Oct. 1998.

### **Activities::**

- Member, U.S. Association for Computational Mechanics (USACM), <http://www.usacm.org>
- Volunteer Tutor, Santa Clara Pueblo, NM, 2001.
- Volunteer, Cerro Grande Cleanup Effort, Los Alamos, NM, 2000.
- President, American Society of Engineers from India, Athens, OH Chapter. (1991-1992)
- Volunteer Tutor, Mysore, India, 1987.