

Vita: Vijay Kalivarapu

Name: Vijay Kiran Kalivarapu
Department: Mechanical Engineering
Current Position: Staff Research Scientist (2013 – Present), Virtual Reality Applications Center, Iowa State University, Ames, IA 50011, USA

1. PERSONAL HISTORY AND PROFESSIONAL EXPERIENCE

A. Educational Background

- Iowa State University, IA PhD (Mechanical Engg, Human-Computer Interaction) 2008
 - University at Buffalo, NY MS in Mechanical engineering 2004
 - Andhra University, AP, India BE in Mechanical Engineering 2000
- Preparing Future Faculty Fellow (Iowa State University) 2008

B. List of Academic Positions

- Oct '13 – Present: Staff Research Scientist, Virtual Reality Applications Center, Iowa State University (VRAC), Ames, IA.
- Aug '08 – Sep '13: Postdoctoral Research Associate, Virtual Reality Applications Center, Iowa State University (VRAC), Ames, IA.
- Jan '04 – Aug '08: Graduate Research Assistant, VRAC, Iowa State University, Ames, IA.
- Jan '01 – Dec '03: Graduate Research Assistant, New York State Center for Engineering Design and Industrial Innovation (NYSCEDII), University at Buffalo, NY.

2. PUBLICATIONS

A. Doctoral Dissertation Title

Improving Solution Characteristics of Particle Swarm Optimization through the use of Digital Pheromones, Parallelization, and Graphical Processing Units (GPUs). Advisor: Dr. Eliot Winer

B. MS Thesis Title

An Approach to Convert Vertex-Based 3D Representations to Combinatorial B-Splines for Real-Time Visual Collaboration. Advisor: Dr. Eliot Winer

C. Journal Publications

- [1] **V.K. Kalivarapu**, E.H. Winer, “A Study of Graphics Hardware Accelerated Particle Swarm Optimization with Digital Pheromones”, *Structural Multidisciplinary Optimization Journal*, DOI: 10.1007/s00158-014-1215-7, Accepted December 2014, published online Jan 21, 2015, Springer publications.
- [2] Zou, R., **Kalivarapu, V.**, Winer, E., Oliver, J., Bhattacharya, S., “Particle Swarm Based Source Seeking in Complex and Noisy Environment”, Conditionally accepted pending revisions, *IEEE Transactions on Automation Science and Engineering*, Feb 2015.
- [3] J.L. Foo, **V.K. Kalivarapu**, J. Knutzon, E.H. Winer, and J. Oliver, “Path Planning of Unmanned Aerial Vehicles using B-Splines and Particle Swarm Optimization,” *Journal of Aerospace Computing, Information and Communication*, vol. 6, 2009, pp. 271-290.

- [4] **V.K. Kalivarapu**, E.H. Winer, and J.-L. Foo, “Synchronous parallelization of Particle Swarm Optimization with digital pheromones,” *Advances in Engineering Software*, vol. 40, 2009, pp. 975-985.
- [5] **V.K. Kalivarapu** and E.H. Winer, “A multi-fidelity software framework for interactive modeling of advective and diffusive contaminant transport in groundwater,” *Environmental Modelling & Software*, vol. 23, 2008, pp. 1370-1383.
- [6] **V.K. Kalivarapu** and E.H. Winer, “Asynchronous parallelization of particle swarm optimization through digital pheromone sharing,” *Structural Multidisciplinary Optimization Journal*, vol. 39, 2008, pp. 263-281.
- [7] **V.K. Kalivarapu** and E.H. Winer, “Improving solution characteristics of particle swarm optimization using digital pheromones,” *Structural Multidisciplinary Optimization Journal*, vol. 37, 2008, pp. 415-427.

D. Conferences

- [1] **Kalivarapu, V.**, Bhattacharya, B., Winer, E., Kong, S-C., “Metamodeling and Visualization Methods to Determine the Commercial Feasibility of Bio-Oil Gasification to Synthesize Transportation Fuel”, Submitted for review for the 16th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Dallas, TX, Accepted for publication, June 2015.
- [2] Renner, A., Thompson, F., **Kalivarapu, V.**, Winer, E., Oliver, J., “An Application of Conceptual Design and Multidisciplinary Analysis Transitioning to Detailed Design Stages”, Submitted for review for the 16th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Dallas, TX, Accepted for publication, June 2015.
- [3] **Kalivarapu, V.**, MacAllister, A., Hoover, M., Sridhar, S., Schlueter, J., Civitate, A., Thompkins, P., Smith, J., Hoyle, J., Oliver, J., Winer, E., Chernoff, G., “Game-day Football Visualization Experience on Dissimilar Virtual Reality Platforms”, In proceedings at the IS&T/SPIE Electronic Imaging, San Francisco, CA, February 2015.
- [4] **Kalivarapu, V.**, Zou, R., Bhattacharya, S., Winer, E., Oliver, J., “Standard Particle Swarm Optimization on Source Seeking Using Mobile Robots”, *56th AIAA/ASCE/AHS/ASC Structural Dynamics, and Materials Conference, AIAA Scitech*, DOI: 10.2514/6.2015-0897, Kissimmee, FL, January 2015.
- [5] Zou, R., Zhang, M., **Kalivarapu, V.**, Winer, E., Bhattacharya, S., “Particle Swarm Optimization for Source Localization in Environment with Obstacles”, *IEEE International Symposium on Intelligent Control (ISIC), Part of 2014 IEEE Multi-conference on Systems and Control*, Antibes, France, October 2014.
- [6] Zou, R., **Kalivarapu, V.**, Oliver, J.; Bhattacharya, S., “Swarm optimization techniques for multi-agent source localization”, *2014 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)*, pp.402-407, doi: 10.1109/AIM.2014.6878112, Besançon, France, July 2014, 8-11 July 2014.

- [7] **V.K. Kalivarapu** and E.H. Winer, "Graphics Hardware Acceleration of Particle Swarm Optimization with Digital Pheromones using the CUDA Architecture," *14th AIAA/ISSMO Multidisciplinary Analysis Optimization Conference*, Indianapolis, IN: AIAA 2012-2614, 2012.
- [8] Holub, J., Foo, J.L., **Kalivarapu, V.**, Winer, E., "Three Dimensional Multi-Objective UAV Path Planning Using Digital Pheromone Particle Swarm Optimization", *53rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference*, Honolulu, HI, AIAA 2012-1525, 2012.
- [9] **V.K. Kalivarapu** and E.H. Winer, "Performance of Hardware Accelerated Particle Swarm Optimization with Digital Pheromones on Dissimilar Computing Platforms," *13th AIAA/ISSMO Multidisciplinary Analysis Optimization Conference*, Fortworth, TX: AIAA 2010-9270, 2010.
- [10] **V. Kalivarapu** and E.H. Winer, "Diversity and Frame Invariance Characteristics in Particle Swarm Optimization with and without Digital Pheromones," *51st AIAA/ASME/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Orlando, FL: AIAA-2010-3080, 2010.
- [11] **V.K. Kalivarapu** and E.H. Winer, "Digital Pheromone Implementation of PSO with Velocity Vector Accelerated by Commodity Graphics Hardware," *50th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Palm Springs, CA: AIAA-2009-2192, 2009.
- [12] **V.K. Kalivarapu** and E.H. Winer, "Implementation of Digital Pheromones in Particle Swarm Optimization for Constrained Optimization Problems," *49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Schaumburg, IL: AIAA-2008-1974, 2008, pp. 1-12.
- [13] **V.K. Kalivarapu** and E.H. Winer, "Parallel Implementation of Particle Swarm Optimization (PSO) Through Digital Pheromone Sharing," *Proceedings of the ASME 2008 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference*, Brooklyn, NY: DETC2008-49444, 2008, pp. 907-916.
- [14] **V.K. Kalivarapu** and E.H. Winer, "Implementation of Digital Pheromones in PSO Accelerated by Commodity Graphics Hardware," *12th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Victoria, British Columbia, Canada: AIAA-2008-6021, 2008.
- [15] **V.K. Kalivarapu** and E.H. Winer, "A Statistical Analysis of Particle Swarm Optimization With and Without Digital Pheromones," *48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, April*, Honolulu, HI: AIAA-2007-1882, 2007.
- [16] T. Batkiewicz, K.C. Dohse, **V.K. Kalivarapu**, T. Dohse, B. Walter, J. Knutzon, D. Parkhurst, E.H. Winer, and J. Oliver, "Multimodal UAV Ground Control System," *11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Portsmouth, VA, 2006, pp. 1-10.
- [17] **V.K. Kalivarapu**, J.-L. Foo, and E.H. Winer, "Implementation of Digital Pheromones for Use in Particle Swarm Optimization," *47th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Newport, RI: AIAA 2006-1917, 2006.

- [18] **V.K. Kalivarapu**, E.H. Winer, and J.L. Foo, “A Parallel Implementation of Particle Swarm Optimization Using Digital Pheromones,” *11th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Portsmouth, VA: AIAA 2006-6908, 2006.
- [19] **V.K. Kalivarapu**, A. Mckean, E.H. Winer, J. Vance, and J. Duncan, “Using a Web-Based Query Engine and Immersive Virtual Reality to Select and View 3D Anthropometry in Vehicle Operator Workstation Design,” *46th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics & Materials Conference, 18 - 21 April 2005, Austin, TX*, Austin, TX: AIAA 2005-1814, 2005.
- [20] **V.K. Kalivarapu** and E.H. Winer, “An Approach to Convert Vertex-Based 3D Representations to Combinatorial B-Splines for Real-Time Visual Collaboration,” *43rd AIAA Aerospace Sciences Meeting and Exhibit 10 - 13, Reno, NV*, Reno, NV: 2005.
- [21] A. Vaze, **V.K. Kalivarapu** and E.H. Winer, “Data Modeling and Handling for Analysis and Visualization in a Collaborative Setting,” *10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Albany, NY: AIAA 2004-4603, 2004.

E. Invited Presentations

- [1] **Kalivarapu, V.**, Galvin, G., “Best Practices Managing and Maintaining Large Scale Visualization Clusters”, 2013 Nvidia GPU Tech Conference, Presentation ID: GTC 2013 – ID S3165, San Jose, CA, March 2013.
- [2] **Vijay Kalivarapu**, “Virtual Reality for Real World Applications”, Indian Institute of Science, Bangalore, India, December 2010.
- [3] **Vijay Kalivarapu**, “Changes in Virtual Reality Technology”, 2008 ASABE/ASME/SME/SAE Joint Section Meeting, Waterloo, IA November 2008.

E. Grant and Proposal Writing

- [1] “Jack Trice Stadium Game-Day Virtual Reality Experience”, 2014. PI: James Oliver, Co-PI(s): Eliot Winer, Vijay Kalivarapu. A funded project to develop solutions to simulate game day experience for potential football recruits using Immersive Virtual Reality and Head Mounted Displays such as the Oculus Rift. **Project status: Funded and on-going.**
- [2] “Magnetic Fields and the Brain”, PI: Ravi Hadimani, Co-PI: Vijay Kalivarapu. 2014. A proposal to organize a workshop to educate high-school students about the benefits of Transcranial Magnetic Stimulation using Virtual Reality. **Project status: Proposal accepted.**

Significant contributions in preparing the following grant proposals and project statements of work:

- [3] “Experiments, Technoeconomics, and Optimization of Bioenergy Systems Based on Bio-Oil Gasification”, 2012. PI: Dr. Song-Chang Kong, Co-PI(s): Drs. Robert Brown, Eliot Winer, and Guiping Hu. **Project status: Funded and on-going.**
- [4] “Innovative Solutions for Road Transportation (of a Combine Harvester) Project Statement of Work”, 2012. PI(s): Drs. Eliot Winer, and Jim Oliver. **Project status: Funded and completed.**
- [5] “Large-Scale Optimization using Evolutionary Algorithms on GPU Architectures”, 2009. PI: Dr. Eliot Winer. Project status: Not funded.

3. TEACHING

Term	Class Title	Credit Hours	Enrollment	Lab	TA
Fall '14 (current)	ME 425/525, HCI 525x – Optimization Methods for Complex Engineering Problems	3	34	No	No
Fall '13	ME 270 – Introduction to Mechanical Engineering Design	3	35	Yes	Yes
Spring '12	ME 425/525, HCI 525x – Optimization Methods for Complex Engineering Problems	3	39	No	No
Spring '11	ME 425/525, HCI 525x – Optimization Methods for Complex Engineering Problems	3	23	No	No
Spring '10	ME 425/525, HCI 525x – Optimization Methods for Complex Engineering Problems	3	42	No	No
Fall '08	ME 557/CprE 557 – Computer Graphics and Geometric Modeling, Section C, XE	3	21	No	Yes
Fall '07	ENGR 160 – Engineering Problems with Computer Applications Laboratory, Section E1	3	36	Yes	No
Spring '07 & Spring '08	ME 425/525 – Mechanical Systems Optimization (co-taught three weeks with Dr. Winer)	3	25	No	No

4. SERVICE (PROFESSIONAL/DISCIPLINARY, AND UNIVERSITY)

A. Reviewer

- [1] American Institute of Aeronautics and Astronautics (AIAA) – Reviewer for peer-reviewed conference proceedings for Multidisciplinary Analysis and Optimization and Multidisciplinary Design Optimization Specialists conferences, 2008 – present.
- [2] AIAA – Student poster reviewer, Multidisciplinary Analysis and Optimization Conference, AIAA Aviation 2014.
- [3] American Society of Mechanical Engineers (ASME), Journal of Computing & Information Science (JCISE), 2010 – 2012.
- [4] American Society of Mechanical Engineers (ASME), Design Engineering Technical Conferences, 2009 – 2012.

B. Conference Chairing

- [1] General Chair: 16th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, AIAA Aviation. To be held in Dallas, TX, June 2015.

- [2] Session Chair: 15th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, AIAA Aviation, Atlanta, GA, June 2014.
- [3] Session Chair: ASME 2010 World Conference on Innovative Virtual Reality (WINVR), Ames, IA, May 2010.
- [4] Session Chair: 5th AIAA Multidisciplinary Design Optimization Specialists Conference, Palm Springs, CA, April 2009.
- [5] Session Chair: 12th AIAA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, Victoria, British Columbia, August 2008.

C. Outreach

- [1] Reach out to recruit college football players to take up Engineering for undergraduate education at Iowa State University (ISU), as a part of the initiative from the ISU athletics department. **May 2014 – present.**
- [2] Routine technological Demonstrations at Virtual Reality Applications Center (VRAC) showcasing research strides in Virtual Reality to arouse interest in STEM fields. Target audience include K-12 students, undergraduate, graduate students, as well as professionals, **2006 – present.**
- [3] Technological presentations about Virtual Reality at a community college in Illinois to recruit minorities into Iowa State University. **August 2009.**
- [4] Engineering and Beyond workshop: Technological demonstrations and presentations in an effort to recruit undergrads into Mechanical Engineering Department at ISU, **November 2005, 2006, 2007.**

D. Workshops and Training

- [1] Summer Program for Interdisciplinary Research and Education – Emerging Interface Technologies (SPIRE-EIT). This is a 10-week NSF Research Experience for Undergrads (REU) program that combines classroom training with hands-on research projects for 12 undergraduate students screened from a pool of applicants across the nation. The goal is to orient the selected undergrads to graduate research and get them excited about attending graduate schools (<http://www.hci.iastate.edu/REU/>)
 - Faculty mentor for three undergraduate students. Role included orienting, training, and make contributions to Emerging Interface Technologies. **Summer 2014.**
 - Coordinated course material: C++ and Computer Graphics using OpenGL to 12 REUs. **Summer 2014, 2013, 2011.**
 - Taught Computer Graphics using OpenGL to 15 REUs. **Summer 2012, 2010, 2009, 2008, and 2007.**
- [2] Train affiliates of Virtual Reality Applications Center – faculty, staff and students each semester on operating the Immersive VR facilities: C6 - a six-sided cave that houses 24 4K resolution Sony

SRX-S105 projectors powered by a 48-node visualization computer cluster, Mirage – a 33' x 11' power wall that houses six DP Titan WUXGA active stereo projectors. **2008 – present.**

- [3] High-School workshop: Training imparted to high-school students at the University at Buffalo, NY for using in-house developed groundwater modeling software, **December 2004.**

5. PROFESSIONAL AFFILIATIONS

- [1] Senior Member, American Institute of Aeronautics & Astronautics (AIAA). Member since 2004.
- [2] Multidisciplinary Design Optimization Technical Committee member, AIAA. Member since 2013.
- [3] Association for Computing Machinery (ACM) – Special Interest Group on Graphics and Interactive Techniques (SIGGRAPH). Student member 2006.