Vinod K. Lakshminarayan
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EDUCATION

University of Maryland, College Park May 2009
Doctor of Philosophy in Aerospace Engineering
Dissertation: Computational Investigation of Micro-Scale Coaxial Rotor Aerodynamics in Hover
Advisor: Dr. James D. Baeder

Indian Institute of Technology Madras, India June 2004
Master of Technology in Aerospace Engineering
(as a part of dual-degree program)
Thesis: Computation of Load on Cylindrical Duct in Supersonic Flow
Advisor: Mr. Rajan S. C.

Indian Institute of Technology Madras, India June 2004
Bachelor of Technology in Aerospace Engineering
(as a part of dual-degree program)

RESEARCH EXPERIENCE

Research Scientist/Engineer November 2014-Present
Science and Technology Corporation
NASA Ames Research Center
Serving as one of the lead developers of the most advanced rotorcraft aeromechanics simulation framework, the U.S Army Helios code, which is the product of the DoD High-performance computing modernization program (HPCMP). Currently pursuing full automation of the high fidelity rotorcraft CFD solution using strand grid framework in Helios.

- Implemented a highly efficient, fully parallel, strand-based compressible finite volume flow solver and integrated it with the python framework of Helios.
- Developed a fully parallel automatic strand volume mesh generation technology.
- Worked on automatic surface mesh generation from CAD.
- Demonstrated fully automatic flow solution starting from CAD for complex aerodynamic problems.

Postdoctoral Research Fellow October 2011-October 2014
Department of Aeronautics and Astronautics
Stanford University
Advisor: Dr. Charbel Farhat
Developed mathematical models and advanced computational algorithms for the analysis of complex systems in aerospace engineering. Worked on uncertainty quantification (UQ) methodologies for wind turbine simulations. Also, performed computational analysis of unconventional wind turbine configuration and assess their potential advantages and disadvantages.

- Proposed ALE-embedded computational framework for Fluid-Structure Interaction (FSI) problems involving large displacement of a boundary layer. It is a simpler alternative to adaptive mesh refinement (AMR).
- Performed nonlinear aeroelastic validation study of extremely flexible flapping wings using ALE-embedded framework.
- Extended embedded boundary framework for compressible turbulent flow and flow-Structure computations on structured and unstructured grids.
- Demonstrated the potential of embedded boundary method for the solution of complex, turbulent, and flexible FSI problems with the simulation of the vertical tail buffeting of an F/A-18 aircraft configuration and the comparison of the obtained numerical results with flight test data.
- Worked on a methodology to reliably estimate numerical errors resulting from spatial, temporal and stochastic approximations of fluid dynamic equations using discrete adjoint equations.
- Assessed the flow physics and performance of shrouded turbines using high resolution computations of the Reynolds Averaged Navier-Stokes equations supplemented with a carefully validated transition model. Guided a gradutate student as a part of this.
- Collaborated with an experimental group to study the advantages and disadvantages of vertical axis wind turbine. Conceptualized a highly efficient, vertical axis wind turbine design for clean energy generation in urban environments

Research Associate/Postdoctoral Research June 2009-September 2011
Alfred Gessow Rotorcraft Center
Department of Aerospace Engineering
University of Maryland, College Park
Advisor: Dr. James D. Baeder
Performed detailed analysis of the aerodynamics of different micro air vehicle (MAV) configurations using CFD. This includes simulation of unconventional rotary wing configurations like ducted and cycloidal rotors along with studying avian-based flapping wing MAVs. Research was also conducted to understand the flow-field established during helicopter brownout situations. Several of these work involved training new graduate students to perform the simulations.

- Validated the performance of a hovering micro-scale shrouded rotor with experimental data and proposed an improved shroud design by performing detailed analysis of the flow physics. The performance benefits of the new design was demonstrated experimentally by the experimental group at the University of Maryland.
- Simulated the flow-field of a hovering micro-scale cycloidal rotor and validated the performance predictions with experimental data. Performed detailed analysis of the flow physics, which will be used to improve the existing design of this configuration.
- Demonstrated the capability of the existing CFD solver solver to provide good performance and flow field prediction of rigid avian-based flapping wings. Coupled the CFD solver with a structural solver to account for the large elastic deformations observed in flapping wings.
- Established the fidelity of the existing CFD solver to provide quantitative understanding of the effects of ground plane on the flow-field of a hovering micro-scale single rotor. In addition, the CFD solution coupled with a particle code was used to

show the capability of the methodology to predict the phenomenological attributes of a brownout cloud.

- Worked on ways to improve the robustness and efficiency of implicit hole-cutting (IHC) methodology, which is used to determine connectivity information between different overset meshes. This work generalizes the IHC algorithm for any mesh topology.

Research Assistant/Ph.D. Candidate August 2004-May 2009
Alfred Gessow Rotorcraft Center
Department of Aerospace Engineering
University of Maryland, College Park
Advisor: Dr. James D. Baeder
Conducted research in studying the aerodynamics of micro-scale coaxial rotor in hover, with the objective of developing a computational platform that can be used in improving the capabilities of current rotary-wing MAVs.

- Extended an existing compressible overset RANS solver to study low Mach number and low Reynolds number flow by implementing time-accurate low Mach preconditioner.
- Improved grid connectivity methodology to allow better transfer of information between various overset meshes. This involves implementation of an improved iblanking methodology.
- Validated the performance and wake data of micro-scale single rotor in hover with experiment for different leading and trailing edge geometries.
- Validated the mean performance of full-scale and micro-scale coaxial rotor in hover with experimental data.
- Analyzed the flow physics of hovering micro-scale single rotor, full-scale coaxial rotor and micro-scale coaxial rotor in detail.

Masters Research June 2003-June 2004
Department of Aerospace Engineering
Indian Institute of Technology Madras, India
Advisor: Mr. Rajan S. C.
Applied source/sink and vortex panel methods to predict normal loads on a cylindrical duct in supersonic flow. The results were validated with those obtained from a commercial CFD solver (FLUENT).

Undergraduate Summer Internship May-June 2002
Department of Aerospace Engineering
Indian Institute of Science, Bangalore, India
Advisor: Dr. Balakrishnan N.
Worked in the initial stages of developing a novel grid-stitching algorithm for generating Cartesian-like meshes.

TEACHING EXPERIENCE

Teaching Assistant August 2003-May 2004
Department of Aerospace Engineering
Indian Institute of Technology Madras, India
Worked as teaching assistant in aerodynamics lab and aircraft design course.

Substitute Teacher 2009-2011
Department of Aerospace Engineering
University of Maryland, College Park
Acted as substitute for Dr. James Baeder in teaching graduate level CFD-I and CFD-II courses.

HONORS/AWARDS

James A. Clark Research Scholarship 2004-2005
Department of Aerospace Engineering
University of Maryland, College Park

First prize in Lockheed Martin "Innovate the Future" challenge 2012
Conceptualized a highly efficient, vertical axis wind turbine design for clean energy generation in urban environments as a part of the winning team.

One of the the ten winners in GoFly Phase 1 2018
Part of a winning team in the Boeing-sponsored competition pushing the boundaries of innovation, engineering, and transportation to create a personal flying device for anyone, anywhere.

PUBLICATIONS

Peer Reviewed Articles

1. Roget, B., Sitaraman, J., **Lakshminarayan, V.,** and Wissink, A., "Prismatic Mesh Generation Using Minimum Distance Fields," *Computers & Fluids,* Vol. 200, 104429 (2020).
2. Jude, D., Sitaraman, J., **Lakshminarayan, V.,** and James Baeder, "An Overset Generalised Minimal Residual Method for the Multi-Solver Paradigm," *International Journal of Computational Fluid Dynamics,* Vol. 34, (1), pp. 61–74, (2020).
3. Walther, C. M., Saemi, F., Benedict, M., and **Lakshminarayan, V. K.,** "Symmetric Versus Asymmetric Pitching of a Cycliodal Rotor Blade at Ultra-Low Reynolds Numbers," *Journal of Aircraft,* Vol. 56 (3), pp. 1179–1199 (2019).
4. **Lakshminarayan, V. K.,** Sitaraman, J., Wissink, M., "Sensitivity of Rotorcraft Hover Predictions to Mesh Resolution in Strand Grid Framework," *AIAA Journal,* Vol. 57, (3), pp. 3173–3184 (2019).
5. **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Application of Strand Grid Framework to Complex Rotorcraft Simulations," *Journal of the American Helicopter Society,* 62, 012008 (2017).
6. **Lakshminarayan, V. K.,** Sitaraman, J., Roget, B. and Wissink, A. M., "Development and Validation of a Multi-Strand Solver for Complex Aerodynamic Flows," *Computers & Fluids,* Vol. 147, pp. 41–62 (2017).
7. Benedict, M., **Lakshminarayan, V. K.,** Pino, J., and Chopra, I., "Aerodynamics of a Small-Scale Vertical Axis Wind Turbine with Dynamic Blade Pitching," *AIAA Journal,* Vol. 54, (3), pp. 924–935. (2016).
8. **Lakshminarayan, V. K.,** Duraisamy, K., and Alonso, J., "Adjoint-Based Estimation and Control of Spatial, Temporal and Stochastic Approximation Errors in Unsteady Flow Simulations," *Computers & Fluids,* Vol. 121, pp. 180–191 (2015).

9. Aranake, A. C., **Lakshminarayan, V. K.,** and Duraisamy, K., "Computational Analysis of Shrouded Wind Turbine Configurations," *Renewable Energy journal,* Vol. 75, pp. 818–832 (2015).
10. Lind, A. H., Jarugumilli, T., Benedict, M., **Lakshminarayan, V. K.,** Jones, A. R., and Chopra, I., "Flow Field Studies on a Micro Air Vehicle-Scale Cycloidal Rotor in Forward Flight," *Experiments in Fluids,* 55:1826 (2014).
11. **Lakshminarayan, V. K.,** Farhat, C., and Main, A.,"An Embedded Boundary Framework for Compressible Turbulent Flow and Flow-Structure Computations on Structured and Unstructured Grids," *International Journal for Numerical Methods in Fluids,* Vol. 76, (6), pp. 366–395 (2014).
12. Aranake, A. C., **Lakshminarayan, V. K.,** and Duraisamy, K., "Assessment of Low-Order Theories for Analysis and Design of Shrouded Wind Turbines using CFD," *Journal of Physics: Conference Series,* **524**, 012077 (2014).
13. Benedict, M., Jarugumilli, T., **Lakshminarayan, V. K.,** and Chopra, I., "Effect of Flow Curvature on the Forward Flight Performance of a MAV-Scale Cycloidal Rotor," *AIAA Journal,* Vol. 52, (6), pp. 1159–1169 (2014).
14. Farhat, C., and **Lakshminarayan, V. K.,** "An ALE Formulation of Embedded Boundary Methods for Tracking Boundary Layers in Turbulent Fluid-Structure Interaction Problems," Vol. 263, pp. 53–70 (2014).
15. **Lakshminarayan, V. K.,** Kalra, T. S., and Baeder, J. D., "Detailed Computational Investigation of a Hovering Microscale Rotor in Ground Effect," *AIAA Journal,* Vol. 51, (4), pp. 893–909 (2013).
16. **Lakshminarayan, V. K.,** and Baeder, J. D., "Technical Note: Improved Shroud Design for Rotary Wing MAV Applications Based on Computational Analysis," *Journal of the American Helicopter Society,* **57**, 045001 (2012).
17. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Microscale Shrouded Rotor Aerodynamics in Hover," *Journal of the American Helicopter Society,* **56**, 042002 (2011).
18. Baeder, J., Duraisamy, K., and **Lakshminarayan, V. K.,** "RANS Predictions of Complex Hovering Rotor Configurations: From Micro Scale to Full Scale," *Computational Fluid Dynamics Journal,* Vol. 18, (3-4):43, pp. 539–579 (2011).
19. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Microscale Coaxial-Rotor Aerodynamics in Hover," *Journal of Aircraft,* Vol. 47, (3), pp. 940–955 (2010).
20. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Micro Hovering Rotor Aerodynamics," *Journal of the American Helicopter Society,* **55**, 022001 (2010).
21. **Lakshminarayan, V. K.,** and Baeder, J. D., "High Resolution Computational Investigation of Trimmed Coaxial Rotor Aerodynamics in Hover," *Journal of the American Helicopter Society,* **54**, 042008 (2009).

Conference Proceedings

1. **Lakshminarayan, V. K.,** Sitaraman, J., Jain, R. and Wissink, A. M., "Improvements to Automated Strand Meshing Capabilities for Rotary Wing Applications," Vertical Flight Society, Transformative Vertical Flight 2020, San Jose, CA, January 21–23, 2020.

2. Tran, S., **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Transition Modeling in HPCMP CREATETM-AV HELIOS v9," AIAA paper-2019-1111, AIAA SciTech 2019 Forum, San Diego, CA, January 7–11, 2019.
3. Jude, D., Sitaraman, J., **Lakshminarayan, V. K.,** and Baeder, J. D., "An Overset Generalized Minimal Residual Method for CFD on Heterogeneous Compute Architechtures," AIAA paper-2019-0099, AIAA SciTech 2019 Forum, San Diego, CA, January 7–11, 2019.
4. Sitaraman, J., Roget, B., **Lakshminarayan, V. K.,** and Brazell, M., "High-order Curved Prismatic Mesh Generation Using Minimum Distance Fields," 27th International Meshing Roundtable and User Forum, Albuquerque, NM, October 1–5, 2018.
5. Roget, B., Sitaraman, J., **Lakshminarayan, V. K.,** and Wissink, A. M., "Prismatic Mesh Generation Using Minimum Distance Fields." ICCFD10-219, The 10th International Conference on Computational Fluid Dynamics, Barcelona, Spain, July 9–13, 2018.
6. Tran, S., **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Verification of Turbulence Models Available in CREATE^{TM}-AV HELIOS v8," AIAA paper-2018-1511, 2018 AIAA Aerospace Sciences Meeting, Kissimmee, FL, January 8–12, 2018.
7. **Lakshminarayan, V. K.,** Sitaraman, J., Roget, B., and Wissink, A. M., "Simulation of Complex Geometries Using Automatically Generated Strand Meshes," AIAA paper-2018-0028, 2018 AIAA Aerospace Sciences Meeting, Kissimmee, FL, January 8–12, 2017.
8. **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Sensitivity of Rotorcraft Hover Predictions to Mesh Resolution in Strand Grid Framework," AIAA paper-2017-1672, 55th AIAA Aerospace Sciences Meeting, Grapevine, TX, January 9–13, 2017.
9. Sitaraman, J., **Lakshminarayan, V. K.,** , Roget, B., and Wissink, A. M., "Progress in Strand Mesh Generation and Domain Connectivity for Dual-Mesh CFD simulations," AIAA paper-2017-0288, 55th AIAA Aerospace Sciences Meeting, Grapevine, TX, January 9–13, 2017.
10. **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Application of Strand Grid Framework to Complex Rotorcraft Simulations," AIAA paper-2016-3130, 34th AIAA Applied Aerodynamics Conference, Washington D.C., June 13–17, 2016.
11. **Lakshminarayan, V. K.,** Sitaraman, J., Roget, B., and Wissink, A. M., "Development and Validation of a Multi-Strand Solver for Complex Aerodynamic Flows," AIAA paper-2016-1581, 54th Aerospace Sciences Meeting, San Diego, CA, January 4–8, 2016.
12. Leffell, J. I, Sitaraman, J., **Lakshminarayan, V. K.,** and Wissink, A. M., "Towards Efficient Parallel-in-Time Simulation for Periodic Flows," AIAA-2016-0066, 54th Aerospace Sciences Meeting, San Diego, CA, January 4–8, 2016.
13. Benedict, M., **Lakshminarayan, V. K.,** Garber, J., and Chopra, I., "Experimental and Computational Flow Field Studies of a Small-scale Vertical Axis Wind Turbine with Dynamic Blade Pitching," American Helicopter Society 71st Annual Forum Proceedings, Virginia Beach, VA, May 5–7, 2015.

14. Duraisamy, K., and **Lakshminarayan, V. K.,** "Flow Physics and Performance of Vertical Axis Wind Turbine Arrays," AIAA paper-2014-3139, 32nd AIAA Applied Aerodynamics Conference, Atlanta, GA, June 16–20, 2014.

15. **Lakshminarayan, V. K.,** and Farhat, C., "Nonlinear Aeroelastic Analysis of Highly Flexible Flapping Wings Using an ALE Formulation of Embedded Boundary Method," AIAA paper-2014-0221, AIAA Science and Technology Forum and Exposition 2014, National Harbor, MD, January 13–17, 2014.

16. Kalra, T. S., **Lakshminarayan, V. K.,** and Baeder, J. D., "Effect of Tip Geometry on a Hovering Rotor in Ground Effect: A Computational Study," AIAA paper-2013-2542, 31st AIAA Applied Aerodynamics Conference, San Diego, CA, June 24–27, 2013.

17. **Lakshminarayan, V. K.,** and Farhat, C., "An ALE-Eulerian Formulation of Embedded Boundary Methods for Turbulent Fluid-Structure Interaction Problems," AIAA paper-2013-2441, 21st AIAA Computational Fluid Dynamics Conference, San Diego, CA, June 24–27, 2013.

18. Jarugumilli, T., Lind, A. H., Benedict, M., **Lakshminarayan, V. K.,** Jones, A. R., and Chopra, I., "Experimental and Computational Flow Field Studies of a MAV-scale Cycloidal Rotor in Forward Flight," American Helicopter Society 69th Annual Forum Proceedings, Phoenix, AZ, May 21–23, 2013.

19. Benedict, M., **Lakshminarayan, V. K.,** Pino, J., and Chopra, I., "Fundamental Understanding of the Physics of a Small-Scale Vertical Axis Wind Turbine with Dynamic Blade Pitching: An Experimental and Computational Approach," AIAA paper-2013-1553, 54th AIAA Structural Dynamics, and Materials Conference, Boston, MA, April 8–11, 2013.

20. Aranake, A. C, **Lakshminarayan, V. K.,** and Duraisamy, K., "Computational Analysis of Shrouded Wind Turbine Configurations," AIAA paper-2013-1211, 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, Grapevine, TX, January 7–10, 2013.

21. **Lakshminarayan, V. K.,** Duraisamy, K., and Alonso, J., "Adjoint-Based Estimation and Control of Spatial, Temporal and Stochastic Approximation Errors for Aerodynamic Applications," AIAA paper-2013-518, 51st AIAA Aerospace Sciences Meeting including the New Horizons Forum and Aerospace Exposition, Grapevine, TX, January 7–10, 2013.

22. Aranake, A. C, **Lakshminarayan, V. K.,** and Duraisamy, K., "Assessment of Transition Model and CFD Methodology for Wind Turbine Flows," AIAA paper-2012-2720, 42nd AIAA Fluid Dynamics Conference and Exhibit, New Orleans, LA, June 25–28, 2012.

23. Malhan, R., **Lakshminarayan, V. K.,** Baeder, J. D., Chopra, I., Masarati, P., Morandini, M., and Quaranta, G., "CFD-CSD Coupled Aeroelastic Analysis of Flexible Flapping Wings for MAV Applications: Methodology Validation," AIAA paper-2012-1636, 53rd AIAA Structural Dynamics, and Materials Conference, Honolulu, HI, April 23–26, 2012.

24. Benedict, M., Jarugumilli, T., **Lakshminarayan, V. K.,** and Chopra, I., "Experimental and Computational Studies to Understand the Role of Flow Curvature Effects on the Aerodynamic Performance of a MAV-Scale Cycloidal Rotor in Forward Flight," AIAA paper-2012-1629, 53rd AIAA Structural Dynamics, and Materials Conference, Honolulu, HI, April 23–26, 2012.

25. Kalra, T. S., **Lakshminarayan, V. K.,** Baeder, J. D., and Thomas, S., "Methodological Improvements for Computational Study of Hovering Micro-Rotor in Ground Effect," AIAA paper-2011-3552, 20th AIAA Computational Fluid Dynamics Conference, Honolulu, HI, June 27–30, 2011.

26. Thomas, S., **Lakshminarayan, V. K.,** Kalra, T. S., and Baeder, J. D., "Eulerian-Lagrangian Analysis of Cloud Evolution using CFD Coupled with a Sediment Tracking Algorithm," American Helicopter Society 67th Annual Forum Proceedings, Virginia Beach, VA, May 3–5, 2011.

27. Malhan, R., **Lakshminarayan, V. K.,** Baeder, J. D., and Chopra, I., "Investigation of Aerodynamics of Rigid Flapping Wings for MAV Applications: CFD Validation," Proceedings of the American Helicopter Society International Specialists' Meeting on Unmanned Rotorcraft and Network Centric Operations, Tempe, AZ, January 25–27, 2011.

28. Kalra, T. S., **Lakshminarayan, V. K.,** and Baeder, J. D., "CFD Validation of Micro Hovering Rotor in Ground Effect," American Helicopter Society 66th Annual Forum Proceedings, Phoenix, AZ, May 11–13, 2010.

29. Yang, K., **Lakshminarayan, V. K.,** and Baeder, J. D., "Simulation of a Cycloidal Rotor System Using an Overset RANS Solver," American Helicopter Society 66th Annual Forum Proceedings, Phoenix, AZ, May 11–13, 2010.

30. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Micro-Scale Shrouded Rotor Aerodynamics in Hover," Proceedings of the American Helicopter Society International Specialists' Meeting on Aeromechanics, San Francisco, CA, January 20–22, 2010.

31. **Lakshminarayan, V. K.,** and Baeder, J. D., "Numerical Study of the Effects of Leading and Trailing Edge Geometries and Planform on Micro Hovering Rotor," Proceedings of the American Helicopter Society International Specialists' Meeting on Unmanned Rotorcraft Systems, Phoenix, AZ, January 20–22, 2009.

32. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Small Scale Coaxial Rotor Aerodynamics in Hover," AIAA Paper 2009-1069, 47th AIAA Aerospace Sciences Meeting and Exhibit, Orlando, Florida, January 5–9, 2009.

33. **Lakshminarayan, V. K.,** and Baeder, J. D., "Further Investigation of Micro Hovering Rotor Aerodynamics using Time Accurate Computations," American Helicopter Society 64th Annual Forum Proceedings, Montreal, Quebec, Canada, April 29-May 1, 2008.

34. **Lakshminarayan, V. K.,** and Baeder, J. D., "High Resolution Computational Investigation of Trimmed Coaxial Rotor Aerodynamics in Hover," Proceedings of the American Helicopter Society International Specialists' Conference on Aeromechanics, San Francisco, CA, January 23–25, 2008.

35. **Lakshminarayan, V. K.,** Duraisamy, K. and Baeder, J. D., "Computational Investigation of Coaxial Rotor Aerodynamics in Hover," American Helicopter Society 63rd Annual Forum Proceedings, Virginia Beach, VA, May 1–3, 2007.

36. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Investigation of Micro Hovering Rotor Aerodynamics," Proceedings of the American Helicopter Society International Specialists' Meeting on Unmanned Rotorcraft , Chandler, AZ, January 23–25, 2007.

37. **Lakshminarayan, V. K.,** Bush, B. L., Duraisamy, K. and Baeder, J. D., "Computational Investigation of Micro Hovering Rotor Aerodynamics," AIAA paper-2006-2819, 24th AIAA Applied Aerodynamics Conference, San Francisco, CA, June 5–8, 2006.

Invited Talks

1. **Lakshminarayan, V. K.,** "Development and Validation of a Multi-Strand Solver for Complex Aerodynamic Flows," Advanced Modeling & Simulation (AMS) Seminar Series, NASA Ames Research Center, Moffett Field, CA, March 8, 2016.
2. **Lakshminarayan, V. K.,** "Computational Analysis of the Flow Physics of Complex MAV-scale Systems using a Compressible RANS-based Approach," Seminar at NASA Ames Research Center, Moffett Field, CA, September 3, 2014.
3. **Lakshminarayan, V. K.,** and Farhat, C., "Nonlinear Aeroelastic Analysis of Highly Flexible Flapping Wings Using an ALE Formulation of Embedded Boundary Method," Seminar at US Army Research Laboratory, Aberdeen Proving Ground, MD, January 17, 2014.
4. **Lakshminarayan, V. K.,** and Baeder, J. D., "Computational Study of the Aerodynamics of Hover-Capable Micro Air Vehicles using Compressible RANS-based Approach and Overset Grid Methodology," Seminar at Indian Institute of Science, Bangalore, India, August 18, 2010.

International Conference Presentations

1. **Lakshminarayan, V. K.,** Sitaraman, J., Roget, B., and Wissink, A. M., "Simulation of Complex Geometries Using Automatically Generated Strand Meshes," 14th Symposium on Overset Composite Grids and Solution Technology, College Park, MD, October 1–4, 2018.
2. **Lakshminarayan, V. K.,** Sitaraman, J., and Wissink, A. M., "Application of Strand Grid Framework to Complex Rotorcraft Simulations," 13th Symposium on Overset Composite Grids and Solution Technology, Mukilteo, WA, October 17–20, 2016.
3. **Lakshminarayan, V. K.,** and Farhat, C., "An ALE Formulation of Embedded Boundary Methods for Turbulent Fluid-Structure Interaction Problems," 12th U.S. National Congress on Computational Mechanics, Raleigh, NC, July 22–25, 2013.
4. **Lakshminarayan, V. K.,** and Baeder, J. D., "Application of Overset Grid Methodology to Micro Rotor Simulations," Symposium on Overset Composite Grids and Solution Technology, Moffett Field, CA, September 20–23, 2010.
5. Baeder J. D., Duraisamy, K., and **Lakshminarayan, V. K.,** "Rotorcraft Hovering Wake Predictions: From Micro-scale to Full-Scale," ARO Workshop on Vortex Dominated Flows, NIA, Hampton, VA, June 18–19, 2009.
6. **Lakshminarayan, V. K.,** and Baeder, J. D., "Numerical Study of the Effects of Planform on Micro Hovering Rotor," ARO Rotorcraft Wake Prediction Basic Research Workshop, Atlanta, GA, March 16–17, 2009.

PROFESSIONAL ACTIVITIES

Journal Referee: **1.** *International Journal for Numerical Methods in Fluids* **2.** *AIAA Journal* **3.** *Journal of Aircraft* **4.** *Journal of Aerospace Engineering* **5.** *The Aeronautical Journal* **6.** *International Journal of Micro Air Vehicles* **7.** *Applied Energy Journal.*

Member of American Helicopter Society, 2004-Present.
Member of American Institute of Aeronautics and Astronautics, 2006-Present.
Member of United States Association for Computational Mechanics, 2013-Present.
Student Volunteer at American Helicopter Society 64th Annual Forum Proceedings and Technology Display, Montreal, Quebec, Canada, April 29-May 1, 2008.
Student Volunteer at American Helicopter Society 63rd Annual Forum Proceedings and Technology Display, Virginia Beach, VA, May 1–3, 2007.