

DR. STEPHEN A. HAMBRIC

Consultant in Vibration, Acoustics, and Noise Control, Hambric Acoustics, LLC

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EDUCATION

B.S. Mechanical Engineering, Virginia Polytechnic Institute and State University, 1986.

M.S. Mechanical Engineering, Virginia Polytechnic Institute and State University, 1987.

D.Sc. Mechanical Engineering, George Washington University, 1995.

WORK EXPERIENCE

Consultant, Hambric Acoustics, LLC, December 2012 to present.

- Subject Matter Expert for the US Nuclear Regulatory Commission (NRC). Evaluate comprehensive flow-induced vibration and fatigue assessments for commercial reactor design and power uprate applications.
- Instructor, Institute for Noise Control Engineering (INCE-USA). Teach the third advanced course in INCE-USA's Noise Control Engineering series to practicing engineers.
- Instructor, develop and teach customized short courses on vibro-acoustics and flow-induced vibration and noise, including online interactive demonstrators.
- PCB Piezotronics. Teach online webinars and write white papers on advanced acoustic and vibration instrumentation. See <https://www.pcb.com/about/training> for recent webinars.
- Various small businesses. Provide subject matter expertise in acoustics, vibration, and noise control in vehicles, buildings, turbomachinery, mechanical systems, and communities; including measurements (modal analysis, flow-induced vibration and noise, sound and vibration in buildings) and computational methods (finite element analysis, boundary element analysis, statistical energy analysis, hybrid methods).
- Expert Witness. Provide expert opinion papers and testimony on various topics in acoustics and vibration.

Penn State University, December 1996 to September 2022.

- Research Professor at Applied Research Lab (ARL). Acquired funding for and directed large computational and experimental structural-acoustic and hydro-acoustic projects funded by the U.S. Navy, NASA, and private industry. Main projects focused on propulsor, pump, compressor, and other turbomachinery dynamics and acoustics; fatigue life; noise transmission and vibration in aerospace and automotive vehicles, machinery, and piping systems; vibro-acoustics of composite structures; and passive noise control treatments.
- Director of Penn State's Center for Acoustics and Vibration (CAV), a campus-wide industry-sponsored consortium of faculty and students working in all aspects of sound and vibration. Responsible for recruiting and maintaining corporate sponsors and international liaisons, and directing the annual CAV spring workshop and short course (www.cav.psu.edu)
- Professor, Graduate Program in Acoustics. Taught *ACS 519 - Sound Structure Interaction*, and *ACS 597 - Research and Writing for Acousticians* – on campus and in Penn State's distance education program. Directed graduate students pursuing M.S. and Ph.D. degrees. Periodically taught short courses to private industry in structural-acoustics and noise control.

Mechanical Engineer: Computational Mechanics Office, Naval Surface Warfare Center, Carderock Division (NSWCCD), Bethesda, MD, September 1987 to December 1996.

- Acoustics and Vibration. Supported computational analyses (finite element, boundary element) and measurements of the vibration and acoustics of Navy ship and submarine components.

PROFESSIONAL ACTIVITIES

- *Fellow of the American Society of Mechanical Engineers (ASME)*: Former Chair of Noise Control and Acoustics Division (NCAD).
- *Fellow of the Institute of Noise Control Engineering (INCE)*: Technical Chair of 2004 Noise-Con conference; INCE Board of Directors, 2005-2007; General Chair of Noise-Con 2007 conference, Vice President for Technical Activities 2007-2010; Vice President for Conferences, 2010-2013; General Chair of Internoise 2012, Vice President for Publications 2023 – present.
- *International INCE*, Vice President for the Americas Region, 2013-2019, Vice President for Rules and Governance, 2019 to present.
- Associate Editor, *ASME Journal of Vibration and Acoustics*, October 2005 – September 2011.
- Member, *ASME Standards Committee PTC-36 (Measurement of Industrial Sound)*, 2008-2016.

HONORS AND AWARDS

- Sigma Xi Research Award in Recognition of original developments of power flow techniques in low frequency computational structural acoustics, June 1993.
- Martin Hirschorn IAC Prize for best paper on new and/or improved cost-effective noise control and/or acoustical conditioning products, October 2007.

GRADUATE STUDENTS

Graduated 12 PhD students and 24 Masters degree students in the Penn State Graduate Program in Acoustics and College of Engineering.

PATENTS

- *Expandable Impeller Pump*, McBride, Mallison, Dillon, Campbell, Boger, Hambric, Kunz, Runt, Walsh, and Leschinsky, US Patent 10865801, 15 December 2020.
- *Heart Assist Device with Expandable Impeller Pump*, McBride, Boger, Campbell, Dillon, Hambric, Kunz, Leschinsky, Mallison, Runt, and Walsh, US Patent 10864309, 15 December 2020.

PUBLICATIONS (Refereed Journals)

1. Hambric, S.A., "Power Flow and Mechanical Intensity Calculations in Structural Finite Element Analysis," *ASME Journal of Vibration and Acoustics*, 112 (4), 542-549, October 1990.
2. Hambric, S.A., and Taylor, P.D., "Comparison of Experimental and Finite Element Structure-Borne Flexural Power Measurements for a Straight Beam," *Journal of Sound and Vibration*, 170 (5), 595-605, March 1994.
3. Dai, C., and Hambric, S.A., "A Prototype Marine Propulsor Design Tool Using Artificial Intelligence and Numerical Optimization Techniques," *Transactions of The Society of Naval Architects and Marine Engineers (SNAME)*, 102, 57-69, November 1994.
4. Hambric, S.A., "Approximation Techniques for Broad-Band Acoustic Radiated Noise Design Optimization Problems," *ASME Journal of Vibration and Acoustics*, 117 (1), 136-144, January 1995.
5. Hambric, S.A., "Sensitivity Calculations for Broad-Band Acoustic Radiated Noise Design Optimization Problems," *ASME Journal of Vibration and Acoustics*, 118 (3), 529-532, July 1996.
6. Dirlik, S., Hambric, S., Azarm, S., Marquardt, M., Hellman, A., Bartlett, S., and Castelli, V., "Developing a Prototype Concurrent Design Tool for Composite Topside Structures," *Naval Engineers Journal*, 109 (3), 279-292, May 1997.
7. Hambric, S.A., and Szwerc, R.P., "Predictions of Structural Intensity Fields using Solid Finite Elements," *Noise Control Eng. J.*, Vol 47, No. 6, pp. 209-217, (Nov-Dec 1999).
8. Szwerc, R.P., Burroughs, C.B., Hambric, S.A., and McDevitt, T.E., "Power Flow in Coupled Bending and Longitudinal Waves in Beams," *Journal of the Acoustical Society of America*, 107 (6), 3186-3195, June 2000.
9. Pray, C.M., Hambric, S.A., McDevitt, T.E., and Burroughs, C.B., "Characterization of Folded Beam Waveguide Absorbers for Damping of Flexural Vibrations in a Thick Plate," *Noise Control Engineering Journal*, 48 (6), 185-192, Nov-Dec 2000.

10. Hambric, S.A., Cuschieri, J.M., Halkyard, C.R., Mace, B.R., and Szwer, R.P., "Low-frequency measurements and predictions of the structural-acoustic properties of the INCE standard T-beam structure," *Noise Control Engineering Journal*, 50 (3), 90-99, May-June 2002.
11. Conlon, S.C., and Hambric, S.A., "Hybrid SEA prediction of vibro-acoustic response of satellite equipment panels," *Journal of the Acoustical Society of America*, 113 (3), 1455-1474, March 2003.
12. Hambric, S.A., Hwang, Y.F., and Bonness, W.K., "Vibrations of plates with clamped and free edges excited by low-speed turbulent boundary layer flow," *Journal of Fluids and Structures*, 19, 93-110, January 2004.
13. Yang, M.Y., Lesieutre, G. A., Hambric, S.A., and Koopmann, G.H., "Development of a Design Curve for Particle Impact Dampers," *Noise Control Engineering Journal*, 53 (1), (January-February 2005).
14. Daley, M., and Hambric, S.A., "Simulating and Measuring Structural Intensity Fields in Plates Induced by Spatially and Temporally Random Excitation," *ASME Journal of Vibration and Acoustics*, 127, 451-457, October 2005.
15. Kankey, A.T., Koopmann, G.H., Hambric, S.A., and Fahline, J.B., "Proposed Piezoceramic Excitation for Translational and Rotational Mobility Measurements," *Noise Control Engineering Journal*, 54 (4) 271-281, Jul-Aug 2006.
16. Hambric, S.A., Jarrett, A.W., Lee, G.F., and Fedderly, J.J., "Inferring Viscoelastic Dynamic Material Properties from Finite Element and Experimental Studies of Beams with Constrained Layer Damping," *ASME Journal of Vibration and Acoustics*, 129, 158-168, April 2007.
17. Peltier, L.J., and Hambric, S.A., "Estimating Turbulent-Boundary-Layer Wall-Pressure Spectra from CFD RANS Solutions," *Journal of Fluids and Structures*, 23, 920-937, August 2007.
18. Anderson, B.E., Hughes, W.J., and Hambric, S.A., "On the Steering of Sound Energy Through a Supercritical Plate by a Near-Field Transducer Array," *Journal of the Acoustical Society of America*, 123 (5), 2613-2619, May 2008.
19. Hambric, S.A., Hughes, W.J., Campbell, R.L., and Fahline, J.B., "Numerical Modeling of the Flow-Induced Self Noise of Torpedo Array Sensors," *Journal of Underwater Acoustics*, 58 (3), 435-464, 2008.
20. Hwang, Y.F., Bonness, W.K., and Hambric, S.A., "Comparison of semi-empirical models of turbulent boundary layer pressure spectra," *Journal of Sound and Vibration*, 319, pp. 199-217, January 2009.
21. Daley, M.J., and Hambric, S.A., "A Method to Simulate Structural Intensity Fields in Plates and General Structures Induced by Spatially and Temporally Random Excitation Fields," *ASME Journal of Vibration and Acoustics*, 131, February 2009.
22. Conlon, S.C. and Hambric, S.A., "Damping and induced damping of a lightweight sandwich panel with simple and complex attachments," *Journal of Sound and Vibration*, 322, 901-925, 2009.
23. Anderson, B.E., Hughes, W.J., and Hambric, S.A., "Grating Lobe Reduction in Transducer Arrays through Structural Filtering of Supercritical Plates," *Journal of the Acoustical Society of America*, 126 (2), 612-619, August 2009.
24. Hambric, S.A., Boger, D.A., Fahline, J.B., and Campbell, R.L., "Structure- and fluid-borne acoustic power sources induced by turbulent flow in 90 degree piping elbows," *Journal of Fluids and Structures*, 26, 121-147, 2010.
25. Bonness, W.K., Capone, D.E., and Hambric, S.A., "Low-wavenumber turbulent boundary layer wall pressure measurements from vibration data on a cylinder in pipe flow," *Journal of Sound and Vibration*, 329, 4166-4180, 2010.
26. Barnard, A.R. and Hambric, S.A., "Design and implementation of a shielded underwater vector sensor for laboratory environments," *Journal of the Acoustical Society of America*, 130 (6), EL387-EL391, December 2011.
27. Barnard, A.R., Porter, S., Bostron, J., terMeulen, R., and Hambric, S.A., "Evaluation of crowd noise levels during college football games," *Noise Control Engineering Journal*, 59 (6), 667-680, Nov-Dec 2011.
28. Barnard, A.R., Hambric, S.A., and Maynard, J.D., "Underwater measurement of narrowband sound power and directivity using supersonic intensity in reverberant environments," *Journal of Sound and Vibration*, 331, 3931-3944, May 2012.
29. Shepherd, M.R., Conlon, S.C., Semperlotti, F., and Hambric, S.A., "Structural intensity modeling and simulations for damage detection," *ASME Journal of Vibration and Acoustics*, 134, October 2012.
30. Shepherd, M.R., and Hambric, S.A., "Comment on plate modal wavenumber transforms in Sound and Structural Vibration," *Journal of the Acoustical Society of America*, 132 (4), 2155-2157, October 2012.
31. Hambric, S.A., Shepherd, M.R., Campbell, R.L., and Hanford, A.D., "Simulations and measurements of the vibroacoustic effects of replacing rolling element bearings with journal bearings in a simple gearbox," *ASME Journal of Vibration and Acoustics*, 135, June 2013.

32. Lee, A.H., Campbell, R.L., and Hambric, S.A., "Coupled delayed-detached-eddy simulation and structural vibration of a self-oscillating cylinder due to vortex shedding," *Journal of Fluids and Structures*, 48, 216-234, July 2014.
33. Shepherd, M.R., Hambric, S.A., and Wess, D.B., "The effects of wood variability on the free vibration of an acoustic guitar top plate," *Journal of the Acoustical Society of America*, 136 (5), EL357-EL361, <https://doi.org/10.1121/1.4898740>, November 2014.
34. Shepherd, M.R., and Hambric, S.A., "Minimizing the acoustic power radiated by a fluid-loaded curved panel excited by turbulent boundary layer flow," *Journal of the Acoustical Society of America*, 136 (5), 2575-2585, <https://doi.org/10.1121/1.4896823>, November 2014.
35. Robin, O., Berry, A., Atalla, N., Hambric, S., and Shepherd, M., "Experimental evidence of modal wavenumber relation to zeros in the wavenumber spectrum of a simply supported plate," *J. Acoust. Soc. Am.*, 137 (5), 2978-2981, <https://doi.org/10.1121/1.4919334>, May 2015.
36. Cai, L.W., and Hambric, S.A., "Multiple scattering of flexural waves on thin plates," *ASME J. Vib. Acoust.*, 138 (1), 011009-1-10, <https://doi.org/10.1115/1.4031535>, October 2015.
37. Shepherd, M.R., Fahnline, J.B., Dare, T.P., Hambric, S.A., and Campbell, R.L., "A hybrid approach for simulating fluid-loading effects on structures using experimental modal analysis and the boundary element method," *J. Acoust. Soc. Am.*, 138 (5), 3073-3080, <https://doi.org/10.1121/1.4934959>, November 2015.
38. Cai, L.W., and Hambric, S.A., "Movable rigid scatterer model for flexural wave scattering on thin plates," *ASME J. Vib. Acoust.*, 138 (3), 031016, <https://doi.org/10.1115/1.4033060>, April 2016.
39. Barnard, A.R., and Hambric, S.A., "Development of a set of structural-acoustic teaching demonstrations using a simply supported rectangular plate," *Noise Control Engineering Journal*, 64 (4), 500-510, <https://doi.org/10.3397/1/376396>, Jul-Aug 2016.
40. Hambric, S.A., Shepherd, M.R., Schiller, N.H., Snider, R., and May, C., "Quieting a rib-framed honeycomb core sandwich panel for a rotorcraft roof," *Journal of the American Helicopter Society*, 62, 012009, <https://doi.org/10.4050/jahs.62.012009>, 2017.
41. Lee, A.H., Campbell, R.L., Craven, B.A., and Hambric, S.A., "Fluid-Structure Interaction Simulation of Vortex-Induced Vibration of a Flexible Hydrofoil," *ASME J. Vib. Acoust.*, 139, <https://doi.org/10.1115/1.4036453>, August 2017.
42. Hambric, S.A., Ziada, S., and Morante, R., "Boiling water reactor steam dryer alternating stress assessment procedures," *ASME Journal of Nuclear Engineering and Radiation Science*, 4, April 2018, <https://doi.org/10.1115/1.4037898>.
43. Shepherd, M.R., Campbell, R.L., and Hambric, S.A., "A parallel computing framework for performing structural-acoustic optimization with stochastic forcing," *Structural and Multidisciplinary Optimization*, <https://doi.org/10.1007/s00158-019-02389-2>, August 2019.
44. Cody, K.L., Jonson, M.L., Pollack, M.L., and Hambric, S.A., "Fluid-elastic lock-in of a cavity shear layer instability with the modes of a submerged cantilevered beam," *ASME J. Vib. Acoust.*, 141, <https://doi.org/10.1115/1.4044302>, December 2019.
45. Hambric, S.A., Shaw, M.D., and Campbell, R.L., "Wavenumber analyses of panel vibrations induced by transonic wall-bounded jet flow from an upstream high aspect ratio rectangular nozzle," *Advances in Aircraft and Spacecraft Science*, 6 (6), 515-528, <https://doi.org/10.12989/aas.2019.6.6.515>, 2019.
46. Jerome, T.W., Shepherd, M.R., and Hambric, S.A., "Ultrasonic investigation of the pressure profile on the faying surface of fastened aluminum plates," *Mechanical Systems and Signal Processing*, 150, <https://doi.org/10.1016/j.ymssp.2020.107260>, 2021.
47. Wells, S.M., Hambric, S.A., and Brungart, T.A., "Simulating and measuring the vibration and radiated sound of a large industrial chiller," *Noise Control Engineering Journal*, 70 (3), <https://doi.org/10.3397/1/377017>, May 2022.

PUBLICATIONS (Books)

1. Ciappi, E., De Rosa, S., Franco, F., Guyader, J-L., and Hambric, S.A., (editors), *Flinovia – Flow Induced Noise and Vibration Issues and Aspects*, Springer, ISBN 978-3-319-09712-1, 2015.
 - a. Chapter: Hambric, S.A., Shaw, M., Campbell, R.L., and Conlon, S.C., "Calculating structural vibration and stress from turbulent flow induced forces," pp. 343-356.
2. Hambric, S.A., Sung, S.H., and Nefske, D.J., *Engineering Vibroacoustic Analysis: Methods and Applications*, Wiley, 2016.
3. Ciappi, E., De Rosa, S., Franco, F., Guyader, J-L., Hambric, S.A., and Hanford, A.D., (editors), *Flinovia – Flow Induced Noise and Vibration Issues and Aspects - II*, Springer, ISBN 978-3-319-76779-6, 2018.

- a. Chapter: Hambric, S.A., Shaw, M., and Campbell, R.L., "Panel vibrations induced by supersonic wall-bounded jet flow from an upstream high aspect ratio rectangular nozzle," pp. 197-216.
4. Ciappi, E., De Rosa, S., Franco, F., Guyader, J-L., Hambric, S.A., Leung, R.C.K., Clair, V., Maxit, L., Totaro, N., (editors), *Flinovia – Flow Induced Noise and Vibration Issues and Aspects - III*, Springer, ISBN 978-3-030-64807-7, 2021.
 - a. Chapter: Hambric, S.A., and Lysak, P.D., Validation of a Simple Empirical Model for Calculating the Vibration of Flat Plates Excited by Incompressible Homogeneous Turbulent Boundary Layer Flow," pp. 61-86.

PUBLICATIONS (Magazines)

1. Hambric, S.A., "Structural Acoustics Tutorial – Part 1: Vibrations in Structures," *Acoustics Today*, Vol. 2, Issue 4, October 2006.
2. Hambric, S.A., "Structural Acoustics Tutorial – Part 2: Sound-Structure Interaction," *Acoustics Today*, Vol. 3, Issue 2, April 2007.

PUBLICATIONS (Conference Proceedings)

1. Hambric, S.A., "Power Flows and Mechanical Intensities in NASTRAN," *Proceedings of the Seventeenth NASTRAN Users' Colloquium*, pp. 262-289 (April 1989).
2. Hambric, S.A., "Transitioning of Power Flow in Beam Models with Bends," *Proceedings of the Eighteenth NASTRAN Users' Colloquium*, pp. 135-149 (April 1990).
3. Moyer, E.T., and Hambric, S.A., "Adaptive Mesh Design with Quadrilateral and Brick Elements," *Proceedings of the International Conference on Advances in Structural Testing, Analysis and Design (ICSTAD)*, (July 1990).
4. Hambric, S.A., "Influence of Different Wave Motion Types on Finite Element Power Flow Calculations," *Proceedings of the Third International Congress on Intensity Techniques*, pp. 215-223, Senlis - France (August 1990).
5. Everstine, G.C., Cheng, R.S., and Hambric, S.A., "Finite Element Solution of Transient Fluid-Structure Interaction Problems," *Proceedings of the Nineteenth NASTRAN Users' Colloquium*, pp. 162-173 (April 1991).
6. Hambric, S.A., "General Matrix Methods for Finite Element Structure-Borne Power Calculations," *Proceedings of the Seventh FRG/USA Hydroacoustics Symposium*, pp. 30.1-30.16, Munich - Germany (September 1991).
7. Hambric, S.A., and Everstine, G.C., "Acoustic Intensity Calculations for Axisymmetrically Modeled Fluid Regions," *Proceedings of the 20th NASTRAN User's Colloquium*, pp. 166-183 (May 1992).
8. Hambric, S.A., and Everstine, G.C., "Acoustic Intensity Calculations for Finite Element Fluid-Structure Interaction Problems," *ASME PVP-Vol. 231: Fluid-Structure Interaction, Transient Thermal Hydraulics, and Structural Mechanics*, pp. 23-30 (June 1992).
9. Hambric, S.A., "Visualization of Structure-Borne Power in Finite Element Plate Models," *Proceedings of Inter-Noise '92*, pp. 533-536, (July 1992).
10. Hambric, S.A., "Structural-Acoustic Optimization of a Point-Excited, Submerged Cylindrical Shell," *Proceedings of the 4th AIAA/USAF/NASA/OAI Symposium on Multidisciplinary Analysis and Optimization*, pp. 1096-1103, (September 1992).
11. Hambric, S.A., and Quezon, A.J., "Structure-Borne Noise Predictions for a Simple T-Shaped Beam," *Proceedings of Noise-Con 94*, pp. 591-596, (May 1994).
12. Hambric, S.A., and Dai, C., "A Prototype Artificial Intelligence Driven Marine Propulsor Design Tool," *Proceedings of the AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization*, pp. 334-343, (September 1994).
13. Hambric, S.A., and Dai, C., "Minimization of Propeller Induced Vibration Using Artificial Intelligence and Numerical Optimization Techniques," *Proceedings of the First World Congress of Structural and Multidisciplinary Optimization*, (May 1995).
14. Hambric, S.A., "Comparison of Finite Element Predictions and Experimental Measurements of Structure-Borne Powers in a T-Shaped Beam," *Proceedings of Inter-Noise 95*, pp. 685-688 (July 1995).
15. Hambric, S.A., "Optimization Methods for Minimizing Acoustic Radiation from Vibrating Structures," *Proceedings of the Society of Engineering Science 32nd Annual Technical Meeting*, pp. 207-208 (October 1995).
16. Hambric, S.A., "Verification of an Analytic Sensitivity Capability for the Finite Element Structural-Acoustic Program SARA-2D," *Proceedings of InterNoise 96*, pp. 2985-2989 (August 1996).
17. Hambric, S.A. and Szwerc, R.P., "Effects of Joint Modeling Deficiencies on Numerical Structure-Borne Power Predictions in the Round-Robin T-Shaped Beam," *Proceedings of NoiseCon 96*, pp. 461-466, (October 1996).

18. Szwerc, R.P. and Hambric, S.A., "The Measurement of Intensity of Longitudinal and Flexural Waves in Intersecting Beams," *Proceedings of NoiseCon 96*, pp. 473-478, (October 1996).
19. Hambric, S.A. and Szwerc, R.P., "Power Dissipations in a Vibrating Lexan T-Shaped Beam," *Proceedings of NoiseCon 97*, pp. 227-232, (June 1997).
20. Hambric, S.A., Erickson, M.J., Capone, D.E., and Burroughs, C.B., "Finite Element Mode Shapes of an Aluminum Ribbed Panel," *Proceedings of NoiseCon 97*, pp. 245-250, (June 1997).
21. Hambric, S.A., Burroughs, C.B., and Szwerc, R.P., "Improved Comparisons Between Experimental and Finite Element Input Power Levels on the Lexan T-Shaped Beam," *Proceedings of NoiseCon 98*, pp. 321-324 (April 1998).
22. Szwerc, R.P., Hambric, S.A., and Erickson, M.J., "A Comparison of Experimental and Finite Element Structural Intensities on an Aluminum Ribbed Panel," *Proceedings of NoiseCon 98*, pp. 359-364 (April 1998).
23. Pray, C.M., Hambric, S.A., and McDevitt, T.E., "Folded Beam Waveguide Absorber Characterization of the Damping of Flexural Vibrations in a Thick Plate," *Proceedings of Internoise 99*, pp. 891-896 (December 1999).
24. Conlon, S.C., and Hambric, S.A., "SEA Prediction of the Injected Power and Response of Panels with Multiple Attachments," *Proceedings of Internoise 99*, pp. 1707-1712 (December 1999).
25. Hambric, S.A., and Hwang, Y.F., "Vibrations of flat plates excited by highly subsonic turbulent boundary layers," *Proceedings of Internoise 2000*, Nice, France, (August 2000).
26. Daley, M.J., and Hambric, S.A., "Structural Intensity in Plates Excited by Turbulent Boundary Layer Pressure Fields," *Proceedings of NOVEN 2000*, Lyon, France, (September 2000).
27. Banks, J.C., Hambric, S.A., and Byington, C.S., "Characterizing Mechanical System Integrity using Structural Surface Intensity," *Proceedings of NOVEN 2000*, Lyon, France, (September 2000).
28. Hwang, Y.F., and Hambric, S.A., "Forcing function models for structures excited by low-speed flow," *Proceedings of Noise-Con 2000*, Newport Beach, CA, (December 2000).
29. Conlon, S.C., Hambric, S.A., and Manning, J.E., "Computational evaluation of satellite equipment panel modal densities and radiation efficiencies," *Proceedings of Noise-Con 2000*, Newport Beach, CA, (December 2000).
30. Hambric, S.A., Yocum, A.M., Cawley, T., and Willits, S.M., "ARL/Penn State Pump Test Loop," *ASME IMECE2001/NCA-23504*, (November 2001).
31. Pray, C.M., Hambric, S.A., and Munro, A.D., "Modeling of folded beam waveguide absorber behavior using finite element analysis," *Proceedings of NoiseCon 2001*, (October 2001).
32. Hambric, S.A. and Munro, A.D., "Predicted and measured mobilities of the INCE standard ribbed panels," *Proceedings of NoiseCon 2001*, (October 2001).
33. Conlon, S.C., and Hambric, S.A., "Order from disorder: a case study of the effects of structural inhomogeneity on structural-acoustic interaction," *Proceedings of NoiseCon 2001*, (October 2001).
34. Bonness, W.K., Pray, C.M., and Hambric, S.A., "Efficient experimental modal analysis of symmetric structures," *Proceedings of IMAC-XX*, Los Angeles, CA (February 2002).
35. Hambric, S.A., Hwang, Y.F., and Chyczewski, T.S., "Noise Sources and Transmission in Piping Systems," *ASME IMECE 2002/NCA-32682, Proceedings of 2002 ASME IMECE*, New Orleans, Louisiana, (November 2002).
36. Yang, M.Y., Koopmann, G.H., Lesieutre, G.A., and Hambric, S.A., "Attenuation of High Amplitude Vibrations with Particle Dampers," *ASME IMECE 2002/NCA-32689, Proceedings of 2002 ASME IMECE*, New Orleans, Louisiana, (November 2002).
37. Campbell, R.L., and Hambric, S.A., "Effects of Equipment Loading on the Vibrations of Edge-Stiffened Plates and Associated Modeling Issues," *ASME IMECE 2002/NCA-32692, Proceedings of 2002 ASME IMECE*, New Orleans, Louisiana, (November 2002).
38. Pray, C.M. and Hambric, S.A., "Finite Element Study of Harmonic Forcing Function Scattering Mechanisms for Cylindrical Structures," *ASME IMECE 2002/NCA-32686, Proceedings of 2002 ASME IMECE*, New Orleans, Louisiana, (November 2002).
39. Munro, A.D., and Hambric, S.A., "Modeling Folded Beam Waveguide Absorber Behavior Using Translational and Rotational Degree of Freedom Frequency Response Coupling," *Proceedings of NoiseCon 2003*, Cleveland, Ohio, (June 2003).
40. Hambric, S.A., Peltier, L.J., Fahline, J.B., Boger, D.A., and Poremba, J.E., "Structural and Acoustic Noise Sources due to Turbulent Flow through an Elbow – Formulation of Analysis Methods," *ASME IMECE2003/NCA-41525, Proceedings of 2003 ASME IMECE*, Washington, DC (November 2003).
41. Hambric, S.A., Smith, E.C., Szefi, J.T., and Campbell, R.L., "Helicopter transmission noise mechanisms, analysis methods, and noise reduction techniques," *Proceedings of NoiseCon 2004*, Baltimore, Maryland (July 2004).

42. Conlon, S.C., Hambric, S.A., and Bonness, W.K., "Evaluation of a reverberant water tank for radiated power measurements," *Proceedings of NoiseCon 2004*, Baltimore, Maryland (July 2004).
43. Doty, B.J., Hambric, S.A., Fahnlne, J.B., and Conlon, S.C., "Structural-acoustic measurements of a submerged cylindrical shell," *Proceedings of NoiseCon 2004*, Baltimore, Maryland (July 2004).
44. Hambric, S.A., Lee, G.F., Jarrett, A.W., and Fedderly, J.J., "Inferring viscoelastic dynamic material properties from finite element and experimental studies of constrained layer damping systems," ASME IMECE2004/NCA-59059, *Proceedings of 2004 ASME IMECE*, Anaheim, CA (November 2004).
45. Daley, M.J., and Hambric, S.A., "Simulating and Measuring Structural Intensity Fields in Plates Induced by Spatially and Temporally Random Excitation," ASME IMECE2004/NCA-59060, *Proceedings of 2004 ASME IMECE*, Anaheim, CA (November 2004).
46. Hambric, S.A., Jonson, M.L., Fahnlne, J.B., and Campbell, R.L., "Simulating the Vibro-acoustic Power of Fluid-loaded Structures Excited by Randomly Distributed Fluctuating Forces," *Proceedings of NOVEM 2005*, 18-21 April 2005, St. Raphael, France.
47. Kankey, A., Koopmann, G., Hambric, S., and Fahnlne, J., "Proposed piezoceramic excitation for rotational and translational structural mobility measurements," *Proceedings of NoiseCon 2005*, Minneapolis, MN, October 2005.
48. Doty, B., Hambric, S., Conlon, S., and Fahnlne, J., "Structural-acoustic measurements of pipes with ninety-degree elbows, under water loading," *Proceedings of NoiseCon 2005*, Minneapolis, MN, October 2005.
49. Lai-Fook Cody, K., Hambric, S. and Pollack, M., "Challenges of investigating fluid-elastic lock-in of a shallow cavity and a cantilevered beam at low Mach numbers," ASME IMECE2005-79162, *Proceedings of 2005 ASME IMECE*, Orlando, FL, November 2005.
50. Glotzbecker, R., Hambric, S., and Pollack, M., "Experimental investigation of the structural scattering due to impedance discontinuities on a cylindrical shell," ASME IMECE2005-79724, *Proceedings of 2005 ASME IMECE*, Orlando, FL, November 2005.
51. Hambric, S.A., Mulcahy, T.M., Shah, V.N., Scarbrough, T., and Wu, C., "Flow-induced vibration effects on nuclear power plant components due to main steam line valve singing," *Proceedings of the 9th NRC/ASME Symposium on Valves, Pumps, and Inservice Testing*, Washington, DC, July 2006.
52. Hambric, S.A., Boger, D.A., Fahnlne, J.B., and Campbell, R.L., "Structure- and fluid-borne acoustic power sources in 90 degree piping elbows excited by turbulent flow," ASME PVP2006-ICPVT-11-93043, *Proceedings of 2006 ASME PVP Conference*, Vancouver, Canada, July 2006.
53. Barnard, A.R., Hambric, S.A., Conlon, S.C., and Capone, D.E., "Measuring sound power and directivity of a submerged cylinder in a reverberant water tank using intensity based nearfield acoustic holography techniques," *Proceedings of Internoise 2006*, Honolulu, HI, December 2006
54. Barnard, A., Hambric, S.A., Conlon, S.C., and Capone, D.E., "Narrowband sound power measurement using supersonic intensity in underwater reverberant environments," *Proceedings of NoiseCon 2007*, Reno, NV, October 2007.
55. Goss, A., Hambric, S.A., and Fahnlne, J.B., "Comparison of various techniques for computing modal mass," *Proceedings of NoiseCon 2007*, Reno, NV, October 2007.
56. Daley, M.J., and Hambric, S.A., "A method to simulate structural intensity fields in plates and general structures induced by spatially and temporally random excitation fields," ASME IMECE2007-41815, *Proceedings of IMECE2007*, Seattle, WA, November 2007.
57. Argarin, J. D., and Hambric, S.A., "Using fluid velocity in lieu of impeller speed for dimensional analysis and a method for estimating fluidborne noise due to flow turbulence within centrifugal pumps," ASME IMECE2007-41183, *Proceedings of IMECE2007*, Seattle, WA, November 2007.
58. Lai-Fook Cody, K., Hambric, S.A., Pollack, M., and Jonson, M.L., "The Influence of Flow Instability on the Lock-in of Distributed Elastic Resonators," ASME NCAD2008-73016, *Proceedings of ASME NCAD 2008/NoiseCon 2008*, Dearborn, MI, July 2008.
59. Gyurko, J.H., Hambric, S.A., and Reichard, K.M., "Confirmation Testing and Preliminary Dynamic Measurements of a Journal Bearing Test Rig," ASME NCAD2008-73028, *Proceedings of ASME NCAD 2008/NoiseCon 2008*, Dearborn, MI, July 2008.
60. Barnard, A.R., Idrisi, K., Gillett, P., Hambric, S.A., and Johnson, M., "Noise Levels during College Football Games and Associated Effects on Players and Fans," ASME NCAD2008-73012, *Proceedings of ASME NCAD 2008/NoiseCon 2008*, Dearborn, MI, July 2008.
61. Hambric, S.A., and Daley, M., "Structure-Borne Sound in Flat Plates Excited by Turbulent Boundary Layers," *Proceedings of NOVEM 2009*, Oxford, England, April 2009.
62. Shepherd, M.R., and Hambric, S.A., "Minimizing the Sound Radiated by a Cylindrical Shell," *Proceedings of Internoise 2009*, Ottawa, Canada, August 2009.

63. Hambric, S.A., Conlon, S.C., Grisso, B.G., and Shepherd, M.R., "Measurements of the Power Flow Between Bolted Honeycomb Sandwich Panels," *Proceedings of Internoise 2009*, Ottawa, Canada, August 2009.
64. Conlon, S.C., and Hambric, S.A., "Evaluation of a Hard Walled Room for Reverberant Power Measurements: What is Good Enough?," *Proceedings of Internoise 2009*, Ottawa, Canada, August 2009.
65. Hambric, S.A., Barnard, A.R., and Conlon, S.C., "Power transmission coefficients based on wavenumber processing of experimental modal analysis data for bolted honeycomb sandwich panels," *Proceedings of Internoise 2010*, Lisbon, Portugal, 13-16 June 2010.
66. Hambric, S.A., Shepherd, M.R., and Campbell, R.L., "Effects of gears, bearings, and housings on gearbox transmission shafting resonances," ASME IMECE2010-38980, *Proceedings of ASME IMECE 2010*, Vancouver, Canada, 12-18 November 2010.
67. Barnard, A.R., Hambric, S.A., and Maynard, J., "Validation of supersonic intensity in reverberant environments (SIRE) with respect to underwater sources," *Proceedings of NoiseCon 2011*, Portland, Oregon, 25-27 July 2011.
68. Hambric, S.A., et.al., "Experimental vibro-acoustic analysis of honeycomb sandwich panels connected by lap and sleeve joints," *Proceedings of Internoise 2011*, Osaka, Japan, 4-7 September 2011.
69. Hambric, S.A., Fahnlne, J.B., and Campbell, R.L., "Dynamic measurements of an industrial electric motor stator core," ASME IMECE2011-62050, *Proceedings of 2011 ASME IMECE*, Denver, Colorado, 11-17 November 2011.
70. Hambric, S.A., Shepherd, M.R., and Campbell, R.L., "Modeling vibration transmission in gearbox/shafting systems using an augmented component mode synthesis approach," *Proceedings of NOVEM 2012*, Sorrento, Italy, 1-4 April 2012.
71. Shepherd, M.R., and Hambric, S.A., "An approach for structural-acoustic optimization of ribbed panels using component mode synthesis," *Proceedings of Internoise 2012*, New York City, 19-22 August 2012.
72. Hambric, S.A., Shepherd, M.R., May, C., and Snider, R., "Vibro-acoustic measurements and simulations of a rib-framed honeycomb core sandwich panel," *Proceedings of Internoise 2013*, Innsbruck, Austria, 15-18 September 2013.
73. Russell, D.A., Sparrow, V.W., and Hambric, S.A., "Engaging distance education students in online graduate level courses in acoustics, noise and vibration," *Proceedings of Internoise 2013*, Innsbruck, Austria, 15-18 September 2013.
74. Barnard, A.R., and Hambric, S.A., "Development of a set of structural-acoustic teaching demonstrations using a simply supported plate," *Proceedings of NoiseCon 2014*, Ft. Lauderdale, Florida, 8-10 September 2014.
75. Lynch, K., Bauch, P., Hambric, S., and Barnard, A., "A proposed correction for incident sound intensity distribution for diffuse field panel excitation and transmission loss simulations," *Proceedings of NoiseCon 2014*, Ft. Lauderdale, Florida, 8-10 September 2014.
76. Hambric, S.A., Shepherd, M.R., Snider, R., and May, C., "Quieting a rib-framed honeycomb core sandwich panel for a rotorcraft roof," *Proceedings of Internoise 2014*, Melbourne, Australia, 16-19 November 2014.
77. Hambric, S.A., Fahnlne, J.B., Campbell, R.L., Shepherd, M.R., and Conlon, S.C., "Modal based experimental vibro-acoustic analysis of sandwich panels," *Proceedings of NOVEM 2015*, Dubrovnik, Croatia, 13-15 April 2015.
78. Hambric, S.A., "Tutorial on infinite panel sound transmission loss simulations," *Proceedings of Internoise 2015*, San Francisco, CA, USA, 9-12 August 2015.
79. Hambric, S.A., and Shepherd, M.R., "Measurements of the air-borne and structure-borne sound power transmission through a quiet honeycomb core sandwich panel for a rotorcraft roof," *Proceedings of Internoise 2015*, San Francisco, CA, USA, 9-12 August 2015.
80. Hambric, S.A., "Tutorial on the vibroacoustics of composite sandwich panels," *Proceedings of Internoise 2016*, Hamburg, Germany, 21-24 August 2016.
81. Jerome, T.W., Hambric, S.A., and Shepherd, M.R., "Vibration Amplitude and Fastener Torque Dependence of Damping in a Jointed Structure," *Proceedings of ASME 2017 International Design Engineering Technical Conference*, Cleveland, Ohio, August 2017.
82. Wells, S.M., Brungart, T.A., and Hambric, S.A., "Chiller sound radiation measurements and modeling," *Proceedings of NoiseCon 2017*, Grand Rapids, MI, June 2017.
83. Hambric, S.A., "I-INCE Symposium report on flow-induced noise and vibration," *Proceedings of Internoise 2017*, Hong Kong, August 2017.
84. Jerome, T.W., Shepherd, M.R., and Hambric, S.A., "Acoustic excitation of a flanged joint," *Proceedings of IMAC-XXXVI*, Orlando, Florida, February 2018.

85. Hambric, S.A., Shaw, M., and Campbell, R.L., "Wavenumber analyses of panel vibrations induced by supersonic wall-bounded jet flow from an upstream high aspect ratio rectangular nozzle," *Proceedings of NOVEN 2018*, Ibiza, Spain, May 2018.
86. Wells, S., Hambric, S.A., and Brungart, T.A., "Experimental investigation of water cooled centrifugal chiller sound radiation," *Proceedings of NOVEN 2018*, Ibiza, Spain, May 2018.
87. Hambric, S.A., and Barnard, A.R., "Tutorial on wavenumber transforms of structural vibration fields," *Proceedings of Internoise 2018*, Chicago, August 2018.
88. Cunsolo, J., Brungart, T.A., and Hambric, S.A., "Noise transmission from a small hermetic reciprocating compressor," *Proceedings of Internoise 2018*, Chicago, August 2018.
89. Jerome, T.W., Shepherd, M.R., and Hambric, S.A., "Acoustic excitation of flanged joint," *Nonlinear Dynamics*, Vol. 1, 211-224, June 2018.
90. Hambric, S.A., "To infinity and beyond – the amazing uses of infinite structure mobility theory (plenary lecture)," *Proceedings of Internoise 2019*, Madrid, Spain, June 2019.
91. Hambric, S.A., "Fantastic vibroacoustic resources and where to find them," *Proceedings of Internoise 2020*, Seoul Korea, August 2020.
92. Hambric, S.A., "Tutorial on Acoustic Fluid Loading of Structures," *Proceedings of Internoise 2021*, Washington DC, August 2021.
93. Hambric, S.A., "Practical tutorial on cylindrical structure vibro-acoustics part 1 – vibrations," *Proceedings of Internoise 2022*, Glasgow, Scotland, August 2022.
94. Jerome, T., Shepherd, M., and Hambric, S., "Variability in measured resonance frequencies and loss factors of a bolted panel structure," *Proceedings of NOVEN 2023*, Auckland, NZ, Jan 2023.
95. Hambric, S.A., "Practical tutorial on cylindrical structure vibro-acoustics part 2 – acoustics," *Proceedings of Internoise 2023*, Chiba, Japan, August 2023.