

CONTACT
INFORMATION

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BIOGRAPHY

Chris is founder and president of Radial Acoustics, Inc. and has been working in the fields of acoustics, noise and vibration for over 16 years. His expertise is focused on the propagation of acoustic and elastodynamic waves in complex media and structures, and how to manipulate sound and vibration using computational design of materials. His experience includes designing noise and vibration control systems for the rail transit industry and their specification, modeling of vibration propagation in layered soils and its interaction with subway tunnels/stations, environmental impact assessments for noise and vibration, and passive underwater acoustics. Chris is a member of the Institute of Noise Control Engineering and the Acoustical Society of America.

EDUCATION

Ph.D. Materials Science, The University of Vermont, Burlington, VT, 2007
B.A. Physics, The University of Vermont, Burlington, VT, 2002

PROFESSIONAL
EXPERIENCE

President and CEO, Radial Acoustics, Inc., San Gabriel, CA 2020 to present
• Oversee all operations of the company which provides noise and vibration consulting services for rail projects.

Principal Associate, ATS Consulting, Pasadena, CA 2015 to present

- Manage and support a variety of projects in noise & vibration assessment and control, with a focus on rail transit. Projects have included finite element design of floating slab track, predicting vibration from tunnel boring machines, unique groundborne noise mitigation projects, in-service testing of low vibration trackforms, and community/construction noise & vibration assessments (NEPA, CEQA) for urban rail systems. Experience with FTA procedures and guidelines for rail projects.
- Networking, proposals, budget and business development duties.
- Projects have included:
 - LA Metro: Regional Connector, Purple Line Phase 2 & 3, Gold Line Foothill Phase 2B.
 - Sound Transit: East Link, Federal Way, Northgate Link, Light Rail Vehicle Procurement Qualification Testing (Siemens Mobility)
 - Santa Clara VTA: Capitol Expressway LRT, BART Silicon Valley Phase 2
 - Réseau Express Métropolitain (REM), Montreal, Canada
 - Metrolinx: Eglinton Crosstown LRT, Toronto, Canada

Research Physicist, U.S. Naval Research Laboratory, Washington, DC 2010 to 2015

- Acoustics Division: Advanced Acoustic System Development Section
- Research in advanced wave-functionalized materials. Projects included vibration propagation in highly anisotropic composites, metamaterials, novel refractive devices, non-linear acoustics of bubbly media, and experimental methods.

Postdoctoral Researcher, Dept. of Mech. Eng., University of Hawaii, Honolulu, HI 2007 to 2010

- Research on defense/security related underwater acoustics

Graduate Research Assistant, Dept. of Physics, University of Vermont, Burlington, VT 2002 to 2007

- Graduate research of high frequency wave propagation and scattering in composites. Acoustic effective medium theories and ultrasonic experimental techniques for materials characterization.

TECHNICAL
SKILLS

Instrumentation and Measurement:

- Field equipment for environmental noise and vibration assessments, transfer mobility and force density level measurements of rail vehicles. Sound level meters, accelerometers, instrumented hammers, data loggers. LabView and Matlab for data acquisition and analysis. Mechanical testing (Instron and MTS machines), hydrophones, impedances tubes.

Numerical Analysis and Modeling:

- CadnaA Environmental Noise Prediction Software
- Signal Processing: Matlab, Mathematica, Audacity, Cool Edit Pro
- Computation: FEM - COMSOL Multiphysics, 2.5D coupled FEM-BEM methods, FDTD and other numerical recipes for solving wave equations
- EASE Room Acoustics

PROFESSIONAL
ACTIVITIES

Referee Service

- *J. Earthquake Eng. and Eng. Vibration*
- *Noise Control Engineering Journal*
- *J. Acoustical Society of America*
- *Applied Physics Letters*
- *Physical Review*

Membership

- *Institute of Noise Control Engineering*
- *The Acoustical Society of America*
- *The American Physical Society*
- *Sigma Xi*

SELECTED
PUBLICATIONS

- [1] Naify, C.J., Woolfe, K., **Layman, C.N.**, et al. Designing beam-patterns with tapered leaky wave antennas. *J. Acoust. Soc. Am.* 141 (5), 3574-3575 (2017)
- [2] Rochat, J. and **Layman, C.N.** Combined use of measured and predicted data to help characterize vibration propagation for at-grade and sub-grade rail projects. *NOISE-CON Congress and Conference Proceed.* 882-890, (2016)
- [3] Martin, T.P., Naify, C.J., Skerritt, E.A., **Layman, C.N.**, et al. Transparent gradient index lens for underwater sound based on phase advance. *Phys. Rev. Appl.* 4, 034003 (2015)
- [4] Rohde, C.A., Guild, M.D., Martin, T.P., **Layman, C.N.**, et al. Experimental demonstration of underwater acoustic scattering cancellation. *Nature, Sci. Reports* 5, 13175 (2015)
- [5] Clavo, D.C., Thangawng, A., Nicholas, M. and **Layman, C.N.** Thin Fresnel zone plate lenses for focusing underwater sound. *Appl. Phys. Lett.* 107, 014103 (2015)
- [6] Naify, C.J., Martin, T.P., **Layman, C.N.**, Calvo, D.C., and Orris, G.J. Underwater acoustic omnidirectional absorber. *Appl. Phys. Lett.* 104, 073505 (2014)
- [7] **Layman, C.N.**, et al. Highly anisotropic elements for acoustic pentamode applications. *Phys. Rev. Lett.* 111, 024302 (2013)
- [8] Naify, C., **Layman, C.N.**, Martin, T., Calvo, D. and Orris, G. Evaluation of an acoustic metamaterial leaky-wave antenna. *Proceedings of Meetings on Acoustics* 19, 065044 (2013)
- [9] **Layman, C.N.**, et al. G. Broadband transparent periodic acoustic structures. *Proceedings of Meetings on Acoustics* 19, 065043 (2013)
- [10] Naify, C.J., **Layman, C.N.**, et al. Variable index transmission line metamaterial as an acoustic leaky-wave antenna. *Appl. Phys. Lett.* 102, 203508 (2013)
- [11] Calvo, D., Thangawng, A. and **Layman, C.N.** Low-frequency resonance of an oblate spheroidal cavity in a soft elastic medium. *J. Acoust. Soc. Am.* 132 EL1 (2012)
- [12] Martin, T.P., **Layman, C.N.**, et al. Elastic shells with high-contrast material properties as acoustic metamaterial components. *Phys. Rev. B* 85 161103(R) (2012)
- [13] **Layman, C.N.**, et al. Designing acoustic transformation devices using fluid homogenization of an elastic substructure. *Appl. Phys. Lett.* 99 163503 (2011)
- [14] Sou, I.M., Allen, J.S., **Layman, C.N.**, Ray, C., et al. A synchronized particle image velocimetry and infrared thermography technique applied to an acoustic streaming flow. *Exp. Fluids.* 51, 5 (2011)
- [15] **Layman, C.N.**, et al. Characterization of acoustic streaming and heating using synchronized infrared thermography and particle image velocimetry. *Ultrason. Sonochem.* 18, 1258-1261 (2011)
- [16] Cai M., Sou, I.M., **Layman C.N.**, Bingham B. Characterization of the acoustic signature of a small remotely operated vehicle for detection. *Proceedings of OCEANS* 1, (2010)
- [17] **Layman, C.N.**, et al. The interaction of ultrasound with particulate composites. *J. Acoust. Soc. Am.* 119, 1449 (2006)
- [18] Wu, J., **Layman, C.N.**, Murthy, N.S., and Yang, R-B. Determine mechanical properties of particulate composite using ultrasound spectroscopy. *Ultrasonics* 44, e793-e800 (2006)
- [19] **Layman, C.N.** and Wu, J. Theoretical study in applications of doublet mechanics to detect tissue pathological changes in elastic properties using high frequency ultrasound. *J. Acoust. Soc. Am.* 116, 1244 (2004)
- [20] Wu, J., **Layman, C.N.** and Liu, J. Wave equations, dispersion relations, and van Hove singularities for applications of doublet mechanics to ultrasound propagation in bio- and nanomaterials. *J. Acoust. Soc. Am.* 115, 893 (2004)

- [21] **Layman, C.N.** Predicting light rail groundborne noise and vibration from tunnels. *Inter-Noise Conference Proceed.* (2018)
- [22] **Layman, C.N.** Utilizing meta-structures for mitigating low frequency groundborne train vibrations. *APTA Rail* (2017)
- [23] **Layman, C.N.**, et al. Non-traditional noise and vibration mitigation strategies. *APTA Rail* (2016)
- [24] Naify, C., **Layman, C.N.**, Martin, T., Calvo, D. and Orris, G. Evaluation of an acoustic metamaterial leaky-wave antenna. *Proceedings of Meetings on Acoustics* 19, 065044 (2013)
- [25] Naify, C.J., Martin, T.P., **Layman, C.N.**, Calvo, D.C., and Orris, G.J. Two-dimensional broadband acoustic black hole for underwater applications. *J. Acoust. Soc. Am.* 134(5), 4027 (2013)
- [26] **Layman, C.N.**, et al. G. Broadband transparent periodic acoustic structures. *Proceedings of Meetings on Acoustics* 19, 065043 (2013)
- [27] **Layman, C.N.**, Orris, G. and Martin, T. Inertial acoustic metamaterials using high-contrast elastic shells. *11th European Conf. on Underwater Acoustics* (2012)
- [28] Naify, C., Orris, G., Martin, T. and **Layman, C.N.** New directions for manipulation of sound using acoustic metamaterials. *J. Acoust. Soc. Am.* 132, 2012 (2012)
- [29] Martin, T., **Layman, C.N.**, Naify, C., and Orris, G. High-sound speed transparent sonic crystals composed of elastic shells for broadband aqueous applications. *Mats. Res. Soc. Fall Meeting* (2012)
- [30] Calvo, D., Thangawng, A., **Layman, C.N.** Finite-element modeling of sound transmission blocking materials realized using pancake voids in a soft elastomer. *J. Acoust. Soc. Am.* 130, 2331 (2011)
- [31] **Layman, C.N.**, Martin, T., Orris, G. An acoustic directional antenna with isotropic materials. *Mats. Res. Soc. Spring Meeting* (2011)
- [32] **Layman, C.N.**, Martin, T., Orris, G. An acoustic directional antenna with isotropic materials. *J. Acoust. Soc. Am.* 130, 2393 (2011)
- [33] Sou, I.M., Allen, J.S., and **Layman, C.N.** Vortex structures and heat transfer in acoustic streaming flows. *63th Annual Meeting APS Div. Fluid Dynamics* (2010)
- [34] Allen, J.S., Sou, I.M. and **Layman, C.N.** Synchronized thermography and PIV (Particle Imaging Velocimetry) fluid flow measurements. *InfraMation* (2010)
- [35] Anastasiadis, P., **Layman, C.N.**, and Allen, J. S. Targeted ultrasound contrast agents - Mediated endothelial permeability. *J. Acoust. Soc. Am.* 125, 2553 (2009)
- [36] Anastasiadis, P., Klibanov, A. L., **Layman, C.N.**, Bost, W., Zinin, P. V., Lemor, R. M., and Allen, J. S. Employing microbubbles and high-frequency time-resolved scanning acoustic microscopy for molecular imaging. *ICBME 2008, Proceedings* 23, 746 (2009)
- [37] Anastasiadis, P., Mojica, K., **Layman, C.N.**, Matter, M. L., Henneman, J., Barnes, C., and Allen, J. S. Applications of fluorescently labeled lectins for the visualization of biofilms of *pseudomonas aeruginosa* by high-frequency time-resolved scanning acoustic microscopy. *ICBME 2008, Proceedings* 23, 750 (2009)
- [38] **Layman C.N.** and Wu J., Doublet mechanics in acoustics. *J. Acoust. Soc. Am.* 115, 2625 (2004)