Exponent®
Engineering & Scientific Consulting

Richard Hollenbach, Ph.D., P.E.

Senior Engineer | Thermal Sciences
Atlanta
+1-678-412-4845 | rhollenbach@exponent.com

Professional Profile

Dr. Hollenbach utilizes his aptitude in mechanical engineering to provide technical consulting involving thermal-fluid systems, aeroelasticity, aerodynamics, vibrations, fluid-structure interaction, and turbomachinery. He applies the fundamentals of mechanics, aerospace engineering, physics, and mathematical modeling to investigate performance and failures within thermal and fluid systems. He has performed inspections ranging in size from residential to large-scale industrial facilities and processes, written reports for both domestic litigation and international arbitrations, and conducted both experimental and computational analyses for a variety of projects.

Dr. Hollenbach is active within the American Society of Mechanical Engineering (ASME), the American Institute of Aeronautics and Astronautics (AIAA), and Tau Beta Pi Engineering Honor Society. He was recognized as an ASME Early Career Leadership Intern Program to Serve Engineering (ECLIPSE) member as well as a Non-Destructive Testing RISE Leadership Development Program member in 2023. He has reviewed technical articles for Turbo Expo, Global Power and Propulsion Society, and the International Symposium on Unsteady Aerodynamics, Aeroacoustics, and Aeroelasticity of Turbomachines (ISHUAAAT). Dr. Hollenbach's work comprises the following fields:

AVIATION & AEROSPACE SERVICES

Dr. Hollenbach has consulted on large scale aerospace related arbitrations. Previous projects have included assessing composite aircraft coatings, investigating helicopter wreckage, and conducting technical analyses involving combined cycle turbomachinery power plants. He has performed domestic and international inspections in a number of these cases. Dr. Hollenbach draws upon his graduate school work in the field of rotating machinery, where he has published articles at the Turbo Expo Conference and in the Journal of Turbomachinery.

FLUID AND HEAT TRANSFER EQUIPMENT

Dr. Hollenbach has performed technical evaluations on compressor and turbine technologies including fundamental calculations, numerical simulations, and laboratory scale testing. Moreover, he has conducted structural and vibrational analyses to predict and evaluate the failure of turbomachinery blades. He has designed and tested various vibration absorbers, including a sloshing fluid tank for non-linear responses. He uses fundamental thermodynamic principles to evaluate efficiencies of various types of industrial equipment. He applies his knowledge of turbomachinery to renewable energy applications, such as hydro and wind turbines.

CFD AND ADVANCED THERMAL FLUIDS ANALYSIS

Dr. Hollenbach utilizes computational fluid dynamics software to study thermal and fluid systems, including pressurized hydraulic brake cables for vehicle applications. He has also conducted small and large scale analyses. He has previously studied deformable meshes in order to study enforced motion aerodynamics of cylinders and NACA 0012 airfoils. He has also utilized the fundamentals of compressible fluid dynamics to study the performance of a three-stage turbine.

As a Graduate Researcher in the Aeroelasticity Laboratory at Duke University, Dr. Hollenbach utilized a low-speed wind tunnel and high-performance computational fluid dynamics simulations to study unsteady pressures of turbomachinery. Experimentally, he calibrated steady and unsteady pressure sensors and collected lift, drag, moment, and pressure data. He also designed, machined, and constructed experimental rigs including wind oscillation systems and a turbine blade linear cascade. Computationally, Dr. Hollenbach modelled geometry, meshed, and ran large-scale simulations, including steady-state mixing plane as well as transient blade row turbomachinery configurations. Also while at Duke University, he taught machine shop training to undergraduate students and is adept at rapid prototype development both computationally through CAD and physically through 3D printing.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering Materials Science, Duke University, 2022

M.S., Mechanical Engineering Materials Science, Duke University, 2021

B.S., Mechanical Engineering, University of Pittsburgh, 2018

North Carolina Space Grant Fellow, 2020 – 2022

Society of Automotive Engineers Doctoral Scholarship, 2020 – 2022

NSF Graduate Research Fellowship Program Honorable Mention, 2020

Forever Duke Student Leadership Award, 2022

ASME Turbo Expo Early Career Engineer Award, 2022, 2023

ASME Young Engineers Turbo Expo Participation Award, 2021

Gamma Sigma Alpha Graduate Award

Omicron Delta Kappa Graduate Award

Top Graduate Engineering Presenter for Sigma Xi Annual Meeting

Top MEMS Undergrad Student in 2018

Licenses and Certifications

Professional Engineer Mechanical, North Carolina, #056184

Prior Experience

Systems Design Intern within Aeromechanics, Rolls-Royce, 2019

Research Assistant in the High-Performance Simulation Laboratory, University of Pittsburgh, 2018

NSF REU Intern in the Aerothermochemistry and Hypersonics Laboratory, Texas A&M University, 2017

Thermal Hydraulics Intern within Reactor Engineering, Naval Nuclear Laboratory, 2016

Mechanical Engineering Intern within the Department of Engineering, Hydro Instruments, 2015

Professional Affiliations

Non-Destructive Testing RISE Leadership Development – July 2023 - 2024

ASME ECLIPSE Intern, Standards & Certification Sector – June 2023 - 2024

Sigma Xi Scientific Research Honor Society – Associate Membership, July 2020

American Society of Mechanical Engineers – ASME (Student Member), January 2019

American Institute of Aeronautics and Astronautics – AIAA (Student Member), January 2019

Gamma Sigma Alpha Greek Academic Honor Society – Member, November 2017

Pi Tau Sigma Mechanical Engineering Honor Society – Member, November 2016

Omicron Delta Kappa Leadership Honor Society – Member, March 2016

Tau Beta Pi Engineering Honor Society – Member, November 2015

Publications

Hollenbach RL, Kielb R, Sanz I. Unsteady Pressures During Frequency Lock-in of a Cylinder Experiencing Non-Synchronous Vibrations. GT2023-103908. ASME Turbo Expo. June 2023.

Hollenbach RL, Kielb R, Hall K. A Fluid–Structure Interaction Tool Using a Van der Pol-Based Reduced-Order Model for Buffet and Nonsynchronous Vibrations. Journal of Turbomachinery. Vol. 145, Issue 1. January 2023.

Hollenbach RL, Kielb R, Hall K. An Improved Preliminary Design Tool for Turbomachinery Blades Using Van Der Pol Based Reduced-Order Model for Nonsynchronous Vibrations. ASME Turbo Expo. June 2022.

Hollenbach RL, Kielb R, Hall K. Creating a Fluid-Structure Interaction Design Tool Using a Van Der Pol Based Reduced-Order Model for Non-Synchronous Vibrations in Turbomachinery. ASME Turbo Expo. June 2022.

Hollenbach RL, Kielb R. 2022. Unsteady Pressures Analysis of an Oscillating Airfoil Exhibiting Nonsynchronous Vibrations as Applied to Turbomachinery. AIAA SCITECH 2022 Forum.

Hollenbach RL, Kielb R. 2022. Unsteady Pressures Analysis of an Oscillating Cylinder Exhibiting Nonsynchronous Vibrations. AIAA SCITECH 2022 Forum.

Hollenbach, RL, Dowell, E. A Modern Course in Aeroelasticity. Chapters 8, 14. 6th Edition. Springer Link. November 2021. ISBN: 978-3-030-74236-2.

Hollenbach RL, Kielb R, Hall K. 2021. Extending a Van der Pol Based Reduced-Order Model for Fluid-Structure Interaction Applied to Non-Synchronous Vibrations in Turbomachinery. Journal of Turbomachinery. March 2022. 1-14.

Hollenbach RL, Kielb R, Hall K. 2021. Extending a Van der Pol Based Reduced-Order Model for Fluid-Structure Interaction Applied to Non-Synchronous Vibrations in Turbomachinery. ASME Turbo Expo 2021: Turbomachinery Technical Conference and Exposition Volume 2C: Turbomachinery — Design Methods and CFD Modeling for Turbomachinery; Ducts, Noise, and Component Interactions. June 2021.

Presentations

Oral Presentations

Hollenbach, RL. Unsteady Pressures Analysis of a Three-Stage Turbine: Searching for Nonsynchronous vibrations and Lock-in Part II. Lightning Talk. North Carolina Space Symposium. April 2022.

Hollenbach, RL. Unsteady Pressures Analysis of a Three-Stage Turbine: Searching for Nonsynchronous vibrations and Lock-in Part II. Lightning Talk. North Carolina Space Symposium. April 2022.

Hollenbach, RL. Utilizing a Van der Pol Oscillator for Measuring Limit Cycle Oscillations and Phase Shifts in Nonsynchronous Vibrations. Sigma Xi Annual Meeting. November 2021.

Hollenbach, RL. Unsteady Pressures Analysis of a Three-Stage Turbine: Searching for Nonsynchronous vibrations and Lock-in. Lightning Talk. North Carolina Space Symposium. April 2021.

Poster Presentations

Hollenbach, RL. Improving Upon a Van der Pol Based Reduced-Order Model for Investigating Nonsynchronous Vibrations in Turbomachinery. Sigma Xi Conference. November 2020. Won Top Graduate Engineering Poster.

Hollenbach, RL. Unsteady Pressure Analysis of a Three Stage Turbine - Searching for Nonsynchronous Vibrations and Lock-In. GT2020-15995. Turbo Expo. September 2020.

Peer Reviews

ASME Turbo Expo

Global Power and Propulsion Society

AIAA SciTech

International Symposium on Unsteady Aerodynamics, Aeroacoustics, and Aeroelasticity of Turbomachines