

Curriculum Vitae

David E. Schmidt, Ph.D.

Principal, Applied Science Consultants

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Professional Summary

Engineer and computational modeling specialist with more than 30 years of experience in applied predictive modeling across aerospace, defense, automotive, biomedical, power generation, and additive manufacturing sectors. Brings deep expertise in Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) to support simulation-driven engineering workflows, mechanical failure analysis, root cause investigation, expert opinion engagements and product liability litigation across a broad range of complex systems.

In his academic role, Dr. Schmidt developed a certification program in Applied Simulation in Engineering Design and remains actively engaged in advancing simulation tools to support modern engineering practice. Dr. Schmidt is a nationally invited speaker on simulation-driven design, advanced computational methods and the integration of simulation tools into established engineering workflows.

Core Expertise

- **Simulation Codes** Deep technical expertise in Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) applied to complex multi-physics systems.
- **Failure Analysis** Application of simulation-based approaches (FEA and CFD) to conduct mechanical failure analysis, root cause assessment and assessment of contributing failure mechanisms.
- **Verification & Validation** Experienced in model verification and validation in accordance with ASME V&V standards to ensure simulation fidelity and adherence to computational modeling protocols.
- **Training** Demonstrated expertise in embedding FEA-based solutions into established engineering workflows, aligning simulation approaches with industry specific requirements.
- **Simulation-Based Workflows** Advanced proficiency in ANSYS Parametric Design Language (APDL), including development of fully parametric models and automated solution workflows.
- **Engineering Design** Engaged as a technical advisor on product development, mechanical system design, experimental validation, and design for manufacturability spanning a wide spectrum of engineering disciplines and applications.

Education

Ph.D. Carnegie Mellon University, 2009
Computational Mechanics

M.S. University of Pittsburgh, 1991
Engineering - Structural Mechanics

B.S. University of Pittsburgh, 1989
Civil Engineering - Structural Mechanics

Professional Experience

Principal

2006 – present

Applied Science Consultants, LLC

Deliver simulation-driven consulting services across defense, aerospace, manufacturing, power generation, and materials processing, with a focus on forensic analysis, root cause investigation, and litigation support for product failure cases. Focus areas include:

- **Failure Analysis** Conduct failure analysis across a broad range of mechanical systems, applying simulation-based methods and forensic investigation techniques to determine root cause and assess contributing failure mechanisms. Findings support liability litigation and expert opinion engagements.
- **Engineering Design** Consult on product development, mechanical system design, test validation and design for manufacturability across a broad range of engineering applications.
- **Custom Constitutive Models** Develop custom constitutive models within the ABAQUS UMAT framework, supporting advanced applications such as metal powder densification during hot isostatic pressing (HIP).
- **Integrated Workflow Training** Develop and deliver customized training programs for simulation platforms (ANSYS, ABAQUS) to seamlessly simulation-based methodologies into established workflows.
- **Parametric Workflows** Extensive experience developing advanced ANSYS parametric Design Language (APDL) workflows, including fully automated workflows to support repeatable simulation-driven processes.
- **Digital Twin Model Development** Experience in finite element model verification and validation (V&V), including model credibility, uncertainty quantification and validation against experimental data.

Selected Technical Consulting Highlights

Manitoba Hydro Conducted a simulation-informed failure analysis of a critical component at the Grand Rapids Power Generation Station, identifying contributing mechanisms in support of liability litigation.

Product Evaluation Systems Performed a failure analysis and root cause assessment of power generator turbine blade, delivering an expert report in support litigation proceedings.

NAVSEA Designed an enhanced vibrational damping mechanism for the V-22 Osprey helicopter fast rope system, mitigating propeller wash-induced rope movement to improve safety during rescue operations.

A-dec Developed and delivered customized ANSYS-based training course in nonlinear analysis tailored to support the product design cycle for A-dec's line of dental chairs.

Nucor Developed a simulation-based (CFD) assessment method to quantify the efficacy of gas injection ports for Nucor's direct reduced iron (DRI) plant, informing a redesign of the facility's gas delivery system.

Kuchera Defense Systems Performed mechanical design of UAV flight hardware, encompassing structural component design, materials selection and system integration to demonstrate requirement compliance.

Berry Metal Company Designed a water-based thermal management system for oxygen lances used in Basic Oxygen Furnaces (BOF) to improve tip heat dissipation and extend service life.

Ford Motor Company Conducted a thermal dissipation assessment of workstations with a Ford transmission assembly facility, providing simulation-base findings in support of facility redesign for energy savings.

Crucible Research Resigned injection nozzle of a close-coupled powder atomization system using an CFD-based approach, optimizing flow characteristics to improve fine powder yield and overall process efficiency.

L-3 Communications Performed analytical modeling and simulation to develop transfer functions characterizing system dynamic response, informing the design of high-energy fire control systems.

Associate Professor

2010 – present

Department of Mechanical Engineering and Materials Science University of Pittsburgh

Educator and research investigator defined by the seamless integration of industry practice and academic inquiry. Research interests span additive manufacturing, system design, simulation-driven design and multi-scale tissue biomechanics. Career defined by advancing the application of computational approaches to drive simulation-centric design methodologies across both academic and industry settings.

- Director of Applied Engineering Simulation in Design certificate program.
- Director of an industry-partnered capstone design program engaging in applied engineering challenges.
- Teaching includes mechanical design, thermal sciences, applied simulation and computational methods.
- Active research in the integration of generative AI into established engineering workflows.
- Experienced in the development of Digital Twin Frameworks to create high-fidelity system representations.

Research Associate

2006 – 2010

Engineered Tissue Mechanics Laboratory, McGowan Institute for Regenerative Medicine Vascular Bioengineering Laboratory, University of Pittsburgh, Department of Surgery

Developed a predictive multi-scale material model for vascular soft tissue, integrating experimentally derived biomechanical properties with a mechanics-based collagen microstructure model to support engineered heart valve design and abdominal aortic aneurysm risk assessment.

- Developed a custom constitutive model (ABAQUS UMAT) for electro-spun engineered cardiovascular tissue.
- Established a protocol to develop computational-based models driven by patient specific imaging data.
- Designed a novel engineered tissue bioreactor informed by a CFD-based validation process.

Principal Engineer

2001 – 2006

Applied Mechanics Group, Concurrent Technologies Corporation Pittsburgh, PA

Performed analysis and design of engineering systems using ANSYS, MARC, and DEFORM, collaborating closely with the U.S. Army Research and Development Center (ERDEC) and the Office of Naval Research (ONR).

- Developed aerospace design and analysis concepts related to the MH-60 Seahawk helicopter.
- Led development team prototype a next generation shoulder-launched multipurpose weapon (SMAW).
- Explored simulation-informed manufacturing process approaches for metal forming applications.

Senior Engineer

1996 – 2001

L-3 Communications Pittsburgh, PA

Conducted simulation-based design and fabrication of large-scale telescope and directed energy applications. Technical responsibilities included the development of system and component level models to demonstrate structural integrity and system level vibration response.

- Directed energy applications included Tactical Energy Laser (THEL) and Airborne Laser (ABL).
- Established system level control transfer functions to characterize operational vibration response.
- Develop a novel approach to evaluate thermal response of glass-optical structural adhesive.

Research Engineer

1992 – 1996

ANSYS Pittsburgh, PA

Delivered front-line technical support to end users across the ANSYS suite of simulation products, while performing verification and testing to validate product requirements and ensure quality standards as part of an integrated code development process. Additional responsibilities encompassed custom code development, client relationship management, consulting engagements, and support of marketing and pre-sales initiatives.

- Developed documentation and training materials for use in marketing materials and training seminars.
- Prepared benchmark and proof of concept simulations in support of marketing and pre-sales initiatives.

Selected Publications

Erickson E, Bono E, **Schmidt DE**, Chmielus M, “Using Microscopy and Image Analysis to Show Density and Property Variations in Additive Manufactured Ti-6Al-4V”, *Microscopy and Microanalysis*, 25(S2), 2019.

Mostafaei A, Stevens E, Ference J, **Schmidt DE**, Chmielus M, “Binder Jetting of a Complex-Shaped Metal Partial Denture Framework”, *Additive Manufacturing*, 2018, v21.

Stevens E, Schloder S, Bono E, **Schmidt DE**, Chmielus, “Density Variation in Binder Jetting 3D-Printed and Sintered Ti-6Al-4V”, *Additive Manufacturing*, 2018, v22.

Johnson PJ, **Schmidt DE**, Duvvuri U, “Output Control of da Vinci Surgical System’s Surgical Graspers”, *Journal of Surgical Research*, 186(1), 2013.

Salinas N, **Schmidt DE**, Libera, M, Lange, R, Ramaswamy S, “Oscillatory Shear Stress Created by Fluid Pulsatility Versus Flexed Specimen Configurations”, *Computer Methods in Biomedical Engineering*, 2012.

Ramaswamy S, Gottlieb D, **Schmidt DE**, Gaitan DL, Aikawa E, Sales VL, Engelmayr GC, Mayer JE and Sacks MS, “The Role of Organ Level Conditioning on the Promotion of Engineered Heart Valve Tissue Development In-vitro using Mesenchymal Stem Cells,” *Biomaterials*, 2019.

Sacks MS, Merryman WD, and **Schmidt DE**, “On the Biomechanics of Heart Valve Function,” Invited Review, *Journal of Biomechanics*, 2009, 42(12).

Vande Geest JP, **Schmidt DE**, Sacks MS, Vorp DA, “The Effects of Anisotropy on the Stress Analyses of Patient-Specific Abdominal Aortic Aneurysms,” *Annals of Biomedical Engineering*, 2008, 36(6).

Chapters in Edited Books

Ramaswamy S, **Schmidt DE** and Kassab GS, “Biomechanics of Heart Valves” In: Percutaneous Valve Technology: Present and Future, Jose L. Navia and Sharif Al-Ruzzeh (Eds.), Nova Science Publishers, 2012.

Vorp DA, **Schmidt DE** and Makaroun MD, “Can Patient-Specific Biomechanical Evaluation of Abdominal Aortic Aneurysm be used to Predict Rupture?”, In: *Vascular Surgery – Therapeutic Strategies*, Textbook - 34th Annual Northwestern Vascular Symposium, People’s Medical Publishing House, Shelton, CT, 2010.

Selected Conference Presentations

Schmidt DE, *Supporting Capstone Design with Digital Twins*, ASME Verification, Validation and Uncertainty Symposium (VVUQ) Symposium, 2026

Fried J, Kasmer AJ, Kuminkoski A, Larson, JR, **Schmidt DE**, Pearlman J, Mhatre A, *Evaluating Durability of Bushings and Bearings for Wheelchair Use in Adverse Environments*, RESNA Conference 2020,

Marcus M, Mhatre, A, Cousins B, Henry D, Zilavy S, **Schmidt DE**, *Using FEA Software to Simulate Lab-Based Failures in Casters*, RESNA Annual Conference 2019, June 2019.

Schmidt DE and Sacks MS, *Characterizing the Influence of Scaffold Anisotropy on Engineered Heart Valve Leaflet Function*, FDA Workshop on Computer Methods for Cardiovascular Devices, June 2009.

Schmidt DE, Saigal S, LeMay I, *Stress Concentration Evaluation Using the Finite Element Method*, 8th International Colloquium on Asset Management of Aged Plant and Materials: Assessment Methods, EMAS Publishing, Sheffield, U.K., 2005.

Schmidt DE, Muralidhar S, Saigal S, Knupp P, and Leland R, *Comparative Study of Hexahedral and Tetrahedral Elements*, Sandia National Laboratories, Albuquerque, NM, August 2000.

Professional Affiliations

American Society of Mechanical Engineers (ASME), Member
American Society of Engineering Educators (ASEE), Member

Teaching

Undergraduate Courses

- Mechanical Design
- Statics and Strength of Materials
- Introduction to Thermodynamics
- Applied Thermodynamics
- Heat Transfer
- Thermal System Design
- Applied Engineering Simulation in Design
- Capstone Design Project

Graduate Courses

- Applied Solid Mechanics
- Applied Finite Element Analysis
- Finite Elasticity of Soft Tissues
- Biomechanics of Engineered Tissue
- Professional Development Topics

Professional Development

Higher Education Teaching Certificate, Harvard University, 2023