Exponent®
Engineering & Scientific Consulting

Adam A. Cardi, Ph.D., P.E.

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Professional Profile

Dr. Cardi is an experienced mechanical engineer who advises clients on complex problems in design, manufacturing, product testing, and failure analysis. He has specific expertise in machine design, machining, hydraulics, metrology, control systems, dynamics, robotics, vibrations, acoustics, sensors, and signal processing. Dr. Cardi has extensive experience investigating and solving complex multidisciplinary problems in consumer products (e.g., pressure cookers, espresso machines, blenders, pressure washers, trampolines, smart devices, hoverboards, and robots), automotive (e.g., engine vibration, bearings, and lubrication systems), and industrial applications (e.g., valves, machine tools, forklifts, boom lifts, fans, electric motors, and instrumentation).

Dr. Cardi has provided consulting services regarding product recalls, product defect litigation, intellectual property litigation, national defense, and insurance disputes.

Dr. Cardi helps clients navigate all stages of the product/concept development process–from problem identification, to background research, requirements definition, preliminary design, detailed design, prototyping, testing, and design verification. He facilitates knowledge transfer that enables clients to address future challenges and improve their development pipeline. Dr. Cardi utilizes a combination of simulation and experimental techniques to provide timely and accurate answers to clients' problems. He has extensive knowledge of fabrication processes including milling, turning, injection molding, welding, and waterjet. Dr. Cardi also possesses an extensive understanding of the capabilities and limitations of many machine shop tools developed through firsthand experience. He utilizes his knowledge in electrical design, software, and motion control to build robots in his home workshop and has developed embedded software for six (6) microcontroller platforms.

Prior to joining Exponent, Dr. Cardi was a Senior Research Engineer at the Georgia Tech Research Institute (GTRI) where he worked on the mechanical design and precision alignment of high-power radar systems. He also conducted research on the modeling and prediction of chatter (unstable cutting) in metal turning operations, as well as estimating the amount of residual stress in a workpiece after milling.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Georgia Institute of Technology (Georgia Tech), 2009

M.S., Mechanical Engineering, Georgia Institute of Technology (Georgia Tech), 2008

B.S., Mechanical Engineering, Purdue University, 2005

Licenses and Certifications

Licensed Professional Mechanical Engineer, Arizona, #53859

Certified Vibration Analyst, Category II per ISO 18436-2

Academic Appointments

Adjunct Instructor, Mechanical Engineering, Georgia Institute of Technology, 2017

Prior Experience

Senior Research Engineer, Georgia Tech Research Institute, 2015-2017

Senior Engineer, Exponent, 2009-2014

Publications

Cardi AA, Bement MT, Liang SY. Workpiece dynamics during stable cutting in a turning operation. International Journal of Machine Tool Research 2008; 3(4).

Cardi AA, Firpi HA, Bement MT, Liang SY. Workpiece dynamic analysis and prediction during chatter of turning process. Mechanical Systems and Signal Processing 2008; 22:1481-1494.

Cardi AA, Kosbab BD, Overly TG, Schultze JF, Bement MT. Damage assessment through control feedback expansion of modal space. Proceedings of the 24th International Modal Analysis Conference (IMAC-XXIV), Saint Louis, MI, 2006.

Cardi AA, Adams DE, Walsh S. Locating and quantifying ceramic body armor impact forces on a compliant torso using acceleration mapping. Proceedings of SPIE - Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological Systems 2006; V, 6177:617714.

Cardi AA, Adams DE, Walsh S. Ceramic body armor single input force identification on a compliant torso using acceleration response mapping. Structural Health Monitoring - An International Journal 2006; 5(4), 355-372.

Project Experience

Developed signal processing and health monitoring techniques for journal bearings in an internal combustion engine using onboard sensors.

Quantified and interpreted loading on a forklift's occupant restraint system during a frontal collision.

Analyzed boom lift tip-over dynamics and resulting fall arrestor tether forces during an alleged ejection event in a boom lift.

Performed design reviews on various downhole tools used in the oil and gas industry to determine their efficacy, safety, and reliability in deepwater applications.Developed signal processing techniques and machine learning-based classification algorithms for Ground Penetrating Radar systems that detected Improvised Explosive Devices (IEDs) in Iraq and Afghanistan.

Wrote embedded software for six (6) different microcontroller platforms and implemented various communication protocols such as SPI, I2C, and UART.

Developed signal processing techniques to non-destructively and non-invasively assess the health of heart pumps.

Wrote custom embedded firmware for a low power (~20 microwatt average power) Bluetooth Low Energy (BLE) module to verify performance against predicted behavior.

Assessed the likelihood that a door lock in an apartment building could be defeated by traditional lockpicking techniques.

Performed vibration measurements and fatigue life estimation on a residential power meter to determine the likelihood of insulation breakdown.

Assessed vibration levels on large (8 foot) diameter fans in a subway system.

Performed Monte Carlo simulation and error propagation analysis to evaluate the operational benefit of measuring an indirect fire projectile (e.g., a M795 155 mm projectile fired from a howitzer) with a passive optical camera to improve the accuracy of follow-on shots.

Evaluated the effectiveness of a small Unmanned Aerial Vehicle (UAV) to support squad level unit operations.

Developed an extreme high voltage IED countermeasure system that demonstrated the ability to pre-detonate IEDs and detect command wires in a wide variety of environmental conditions.

Managed the development of a rapidly deployable mobile "3D printing" engineering laboratory for the US Army capable of operating in remote environments.

Spent six months traveling throughout southern Afghanistan working as an engineer in the US Army's Rapid Equipping Force (REF) Forward Laboratory where he developed dozens of technologies for military personnel engaged in active combat operations. These technologies included covert/overt surveillance, tagging/tracking/locating, dismounted power solutions, and counter IED enhancements to route clearance packages.