



**Exponent**<sup>®</sup>  
Engineering & Scientific Consulting

## Florin Marcu, Ph.D.

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### Professional Profile

Dr. Marcu is a mechanical engineer with deep industry experience in dynamics, vibration and noise of earth moving equipment and heavy trucks. He has extensive experience evaluating the effect of vibrations on vehicle occupants with a particular interest in seats and cabin suspensions. He has conducted vibration testing both in a lab and in the field with the purpose of evaluating occupant comfort, health and safety, component durability, and vehicle dynamics. Dr. Marcu has led vehicle noise mitigation projects and has experience improving the quality of audible alerts. Dr. Marcu has hands-on experience with sensor selection, subjective and objective testing, and noise and vibration data analysis. Dr. Marcu's work has included support for litigation, risk management and inspections for injury cases, and he has served as an industry expert on several ISO and SAE standards committees.

Dr. Marcu leverages his extensive industry and educational experience to investigate failures in all types of complex mechanical systems and equipment – from mobile equipment to machinery, to industrial production systems, to commercial and residential building equipment and consumer products.

Dr. Marcu's expertise includes:

- Vehicle vibration and its effect on structures, occupants, and vehicle performance
- Passive and active suspension systems
- Seats and seat belts
- Vehicle noise (interior and exterior)
- Construction, mining, and earth moving equipment
- On and off-highway trucks
- Shake and vibration table testing for durability and performance, including human vibration testing
- Field testing
- Immersive, interactive vehicle ride simulators
- Ride Simulator and Motion sickness
- Sensor selection and data acquisition
- Noise and vibration data analysis
- Mine Safety and Health Administration (MSHA) safety training

Prior to joining Exponent, Dr. Marcu led the noise and vibration work at Kenworth trucks. This followed 9 years at Caterpillar where he led the ride simulator laboratory and conducted research on human vibration, semiactive seat and cabin suspensions using a human-rated, 6 degree of freedom shake table. He also investigated incidents related to reported operator actions.

Dr. Marcu has a background in mechanical engineering consistently straddling the divide between theory and application. During his doctoral work at Virginia Tech he developed a dynamic model of a semitruck from first principles which he used to develop a control algorithm for a semiactive cab suspension. Once the model was complete, he modified a semi truck, installed a new cab suspension system, implemented the real-time controller and conducted all the lab and field tuning of the system. His dissertation work culminated in delivery of a working prototype truck with a novel, working semiactive cab suspension.

While completing the Ph.D. work, Dr. Marcu built up a machine shop and developed the IT infrastructure in the research lab. He also performed maintenance on the facility's IT and lab equipment.

## Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Virginia Polytechnic Institute and State University, 2009

B.S., Mechanical Engineering, Tennessee Tech University, 2005

Pi Tau Sigma, Honors Society for Mechanical Engineers

Tau Beta Pi, Engineering Honors Society

Omicron Delta Kappa, National Leadership Honor Society

## Licenses and Certifications

Six Sigma Green Belt

## Academic Appointments

Graduate Research Assistant, Center for Vehicle Systems & Safety, Virginia Tech, 2005-2009

## Prior Experience

Lead NVH Engineer, Kenworth Trucks, 2018-2021

Vibration Engineering Specialist, Caterpillar, Inc., 2015-2018

Seat Suspension Sr. Engineer, Caterpillar, Inc., 2012-2015

Cab Suspension Engineer, Caterpillar, Inc., 2009-2012

Wave Soldering Line Engineer, Denso Manufacturing, 2003-2004

## Professional Affiliations

Society of Automotive Engineers (SAE)

## Languages

Swedish

Romanian

German

## Patents

US Patent 8,682,528: Seat suspension system having fail-safe functionality, March, 2014 (Michael S. Contratto, John C. Spangler, JR., II Charles E. Lewis, Florin M. Marcu, Kristen A. Gerstner).

## Publications

Farjoud, A., Marcu, F., and Schumann, E., "Multi-Physics Modeling of a Cab Suspension System with Fluid Filled Mounts," SAE Technical Paper 2012-01-1912, 2012

Marcu, F., Ahmadian, M., Southward, S., and Jansson, S., "A Methodology for Laboratory Testing of Truck Cab Suspensions," SAE Technical Paper 2009-01-2862, 2009

Marcu, F., Ahmadian, M., Southward, S., and Jansson, S., "A Methodology for Accounting for Uneven Ride Height in Soft Suspensions with Large Lateral Separation," SAE Technical Paper 2009-01-2920, 2009

## Project Experience

### Exponent Projects

Developed Python code to analyze vibration data.

Built and operated a 10ksi hydrostatic pressure test system.

Investigated residential pipe coupling failure.

Conducted HVAC analysis of a large condominium tower VRF heat pump system with 18 condensers and numerous fan coil units.

Conducted HVAC analysis of a residential mini-split heat pump system with multiple air cleaner systems.

Conducted root cause investigation of two fire scenes, one residential and one commercial.

Performed pipe flow calculations in a residential hydronic heating system.

### Projects from past employers

Identified sound quality issues and improved digital display chime audibility by selecting better filter parameters in sound amplifier circuit.

Developed corporate strategy for noise and vibrations performance for OEM vehicle platforms.

Created FEA models and conducted structural analysis of engine and chassis mounted components.

Conducted field investigations at customer sites for cabin noise level and interior sound quality.

Collected vibration data and performed Operational Deflection Shapes (ODS) and Transfer Path Analysis (TPA).

Performed air borne and structure borne noise testing both in lab and in the field.

Collected rigid body vibration data from field equipment and converted it into 6DOF laboratory shake data.

Developed passive and semiactive seat suspension system for off-highway equipment.

Developed semiactive cab suspension for on and off-highway equipment.

Developed control algorithms for suspension systems for a on and off-highway vehicles.

Led and operated several research labs and machine shops with zero injuries.

### Additional Education & Training

Automate the Boring Stuff with Python, Online Course, 2021

Machine Learning, Stanford University, 2020

MSHA Part 48A&B Coal/Metal/Nonmetal Surface & Underground Safety Training, 2011-2018

### Advisory Appointments

Expert member on the following standards committees:

ISO TC108/SC4 Human exposure to mechanical vibration and shock

ISO TC127/SC2 US TAG Earth Moving Machinery

SAE HFTC4 Operator Seating and Ride

### Peer Reviewer

Society of Automotive Engineers