



SMARTUQ®  
*Quantify Every Uncertainty.*

**Smart UQ Workshop**  
**Friday October 15, 2021**  
**8:00am – 12:30pm EDT**  
**\$25.00**

[Register for Workshop](#)

**Title:** Introduction to Machine Learning and Uncertainty Quantification for Automotive Applications

Practitioners who construct complex simulation models of critical systems know that replicating real-world performance is challenging due to uncertainties in simulation, physical tests, and sensor data. These uncertainties arise from sources such as measurement inaccuracies, material property variation, boundary and initial conditions, and modeling approximations. Using ICE and other automotive examples, including from 1D and CFD simulations, this workshop will introduce Machine Learning (ML) and Uncertainty Quantification (UQ) methods, benefits, and tools with a focus on their use in solving automotive engineering challenges.

UQ is a ML process that puts error bands on the results by incorporating real world variability and probabilistic behavior into engineering and systems analysis. UQ answers the question: what is likely to happen when the system is subjected to uncertain and variable inputs. Answering this question facilitates significant risk reduction, robust design, and greater confidence in engineering decisions. Modern UQ techniques use powerful statistical models to map the input-output relationships of the system, significantly reducing the number of simulations or tests required to get statistically defensible answers.

This workshop will discuss basic ML and UQ methods such as Gaussian processes, polynomial chaos expansion, sparse grids, Latin hypercube designs, model calibration, model validation, sensitivity analysis, and how to account for aleatoric and epistemic uncertainties.

**Key Learning Objectives:**

- Basics of ML and UQ methods
- How to apply ML and UQ methods to ICE and other automotive problems
- How to use ML and UQ techniques to save design cycle time and computational resources
- How to develop a robust and reliable design with ML and UQ techniques
- How to interpret ML and UQ results when making decisions

**Speaker/Author**

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