# Robust Engineering (SAFI-M5)

**5 days (35 hours) within a three-week time span**

**Fees : from 2000 € HT to 3800 € HT**

## ONLINE TRAINING

**Dates and detailed fees on aste.asso.fr**

## Target Audience

The course is broad in its aim and approach, and as such suitable for engineers with responsibilities in new product design, development and manufacturing, or current product quality management, who wish to develop advanced knowledge and skills in the application of designed experiments and response surface modelling techniques to underpin model-based problem solving and data-driven product and process design decision-making. The course covers methods to support analysis and modelling based on both physical experiments or tests and virtual experiments.

## Prerequisites

- Attendance of "Statistics for engineering' (SAFI-M1) module would be advantageous but brief introduction is incorporated.
- No significant previous coding experience is required but some experience would be beneficial.
- For delegates not familiar with the Colab environment, attendance of the pre-course session is expected.

## Instructor

Professor Felician CAMPEAN, Professor in Automotive Reliability Engineering and Director of the Automotive Research Centre of the Universiiy of Bradford.

## Training Delivery Methodology

The delivery is designed as a workshop style with an approximate 50/50 split between technical sessions and hands-on exercises, designed to explain the concepts by leveraging relevant industrial case studies.
Delivered online. Learning materials including reading, tutorials and exercises will be provided in electronic format before the course, with example solutions to the exercises where appropriate. Introduction to Colab Python tutorial at introductory level will also be provided.

## Technical equipment

The training is delivered as a virtual classroom, using Microsoft Teams.
Login information sent at the latest 2 days before the training.

## Modes of Asessment

- Attendance sheet signed each half day by the participants and co-signed by ASTE.
- Learning assessment based on:
  - individual or group presentation with argument on a mini-project
  - individual plan for application around a specific project in the workplace of the participant (plan based on the methods and tools from the course).
- Training performance: qualitative assessment of the training by attendants at the end of the session.
- Delivery of a training certificate.

## Access Deadline

Open training: registration at the latest 7 days before the training | In-house training: organisation within 4 weeks minimum.

## Accessibility to Disabled people

Contact our Disability Officer : info@aste.asso.fr

## LEARNING OUTCOMES

Upon completion of this module, the participant will be able to:

- Demonstrate a critical understanding of Design of Experiments and Response Surface Methods (DoE & RSM) in theory and practice that support a range of engineering activities, including design specification, concept selection and product design verification planning and reporting.
- Apply knowledge and skills for planning experiments appropriate to a wide variety of engineering scenarios (including CAE), fit and use empirical transfer functions to study the impact of variation on system performance.
- Master the practice of skills in specialised statistical packages for DoE and RSM using Python in a Google Colab environment
- Demonstrate your analytical and problem-solving skills and ability to communicate effectively in a project team and contribute to teamwork facilitation.

## PROGRAMME

This course introduces methods for the efficient planning of engineering experiments and statistical analysis to develop models that can be used for robustness optimisation through parameter design and tolerance design.

The course is organised as follows:

### Functional modelling and robustness

- Overview of the principles of functional robustness within a system engineering analysis context
- P-Diagram as a model for robustness
- Modelling and measuring variation and transmission of variation.

### Response surface modelling

- Statistical analysis underpinning multiple regression - model fitting, model selection and model validation.

### Classic Design of Experiments

- Planning and analysing design of experiments.
- Exploring various types, ranging from 2-level designs to multi-level designs.
- Introducing a sequential approach for planning and designing tests.
- Criteria for evaluating design quality.

### Advanced response surface modelling and optimisation

- Introduction to space filling designs, optimal Latin Hypercubes, and sequential model-building and model validation techniques
- Flexible response surface methods including stochastic process models (Gaussian Kriging) and radial basis function neural networks.
- Using response surfaces for optimization.
- Examples of application to real world industrial case studies

### Mini-Project

- Strengthening the delivered concepts through application to an industry case study.

**Contact :** **Patrycja PERRIN**
**pperrin@aste.asso.fr // 01 61 38 96 32**