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Robust Design in the age of Digital Twins - an engineering design perspective

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"Cost is more important than quality, but quality is the best way to reduce costs". In the spirit of this inspirational quote from Genichi Taguchi, traditional Robust Design has developed into a well-established part of the quality-by design domain. Including widely known tools such as signal-to noise ratios, quality loss functions, crossed-array experiments, etc., Robust Design offers a coherent and appreciated approach for the parametric optimization of parameter settings that not only ensure sufficient performance but also robustness of the solution against variation and noise.

However, is this traditional Taguchi Quality Engineering toolbox still appropriate for today's engineering practices that are increasingly driven by advanced numerical simulation and optimization tools? This talk approaches this question from a design perspective. Based on an overview of robust engineering examples, the aim is to stimulate a discussion around future challenges of using Digital Twin technology to ensure product robustness throughout an increasingly interdisciplinary development process. This includes i) insights on basic challenges of DoE and surrogate modelling strategies which are usually focused on detailed modelling rather than efficient design decisions, and ii) the underlying requirements towards CAD modelling, simulation toolchains, etc. that are necessary to automatically explore a multidimensional design space. The presentation will furthermore highlight current academic research in model-assisted design space exploration and trade-off approaches that extend the parametric exploration of largely matured products towards earlier conceptual and configuration design decisions.

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