Robust Design – Tutorial Style Workshop

Event duration: 1 day
Organisers and Event Leaders: Thomas Howard (DTU), Martin Ebro (Valcon), Janus Juul Rasmussen (Valcon) & Tobias Eifler (Darmstadt)
Workshop Topic: Robust Design. **Subtopics**: Design Quality, Reliability, Key Performance Indicators.
Participant numbers: 5-25

Abstract

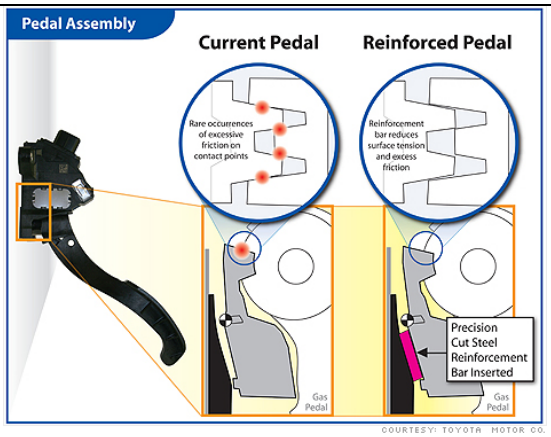
All products experience variance. Whether it be variance due to production tolerances, due to imprecise assembly, or whether due to external disturbances such as temperature change and vibration, it is the designers' job to produce concepts that are insensitive to these variance through '*Robust Design* '. However, it is the case that very few design engineers use, or know or any robust design methods, and as a consequence pass on unfeasible tolerance demands to the production department. The public/customers experience poor design robustness in terms of, product launch delays, product recalls, reliability issues and product quality loss. However, many of the robust design issues take affect within the company in terms of low production yields, slow production ramp-up times, late design changes and emergency commitment of R&D resources to firefight the design reliability issues. The Robust Design Methodology (RDM) provides the designer with quick and simple tools to be used at all stages of design, from the first design sketch to the final detailing and tolerancing. As well as being an aid to the engineers and designers, the RDM is also useful for Managers giving some quantifiable indicators of the current state of the reliability of the design. Furthermore, these indicators are leading indicators and thus it is possible to monitor the development and reliability of a product from the very early stages. Contrast this with current indicators of reliability such as production yield, which are only available once production has begun and the cost of design change is very high.

Workshop format (presentation, case studies, hands-on, use of software):

When we usually conduct robust design workshops with industry, the format and content is designed to suit the organisational roles of the participants, and their experience in the topic of design robustness. We therefore request that the participants fill out a short survey in advance. However, more often than not the workshops fall into one of two categories, for Project and Department Managers where the focus is on measuring and monitoring of concept reliability, or for Designers and Lead Engineers where we focus on analysis tools to guide them towards more robust products.
Previous workshops have included several companies at a time, where general cases and exercises are worked on. However, the majority of the workshops are catered to a single company. Typical format would consist of presentations of robust design theory and cases, guided tutorials of and exercises using RDM, structured

discussions (groups + plenary) aiming to exchange and capture the participants' experiences regarding the aspects of robust design and then redesign or new design of a product chosen by the case company (could also by process and KPI based for managers). The example material can include relevant outputs from previous workshops with European companies, where we have many cases to choose from in the Automotive, Consumer Electronics, Medical and Wind energy industrial sectors.

Example cases from previous workshops

Automotive Case	**Consumer Electronics Case**
Six Theta™ - identifying and quantifying sensitive interfaces in mechanical designs. Understanding how small variations of design parameters can drastically influence product performance – with fatal consequences. Tutorial, discussions, exercises.	Design Clarity and Coupling Degree. A systematic and structured review process for analysing and quantifying the robustness of a mechanical design by the use of a simple and objective metric (Coupling Degree). Methods for improving the metric. Tutorials, discussions, description of what actually happened and the causes and effects.
 *Source: worldcarfans.com*	 *Source: bang-olufsen.com*

Intended audience and benefits:

Audience background	**Relevant benefits – Methods and tools for improving:**
Chief/lead engineers	Tools and methods for making design decisions and communicating design intent.
Project managers	Shorter and more predictable ramp-up process, common language and quality metrics for driving projects.
R&D Managers/ Directors/VPs	Controllable metrics for driving R&D projects, predictability in project execution (milestone passage, launch date)
Production Managers	Shorter ramp-up times, looser specifications (tolerances), increased yield
Quality Managers	Faster validation process, fewer product specifications

Bio-sketch of organisers:

Thomas Howard – Associate Professor in engineering design at the Technical University of Denmark. Winner of prestigious BMW European scientific award. Worked mainly with UK companies, specifically Airbus and Crown Packaging and many SMEs. Co-Chair of ICED11 conference and keynote speaker at numerous events.

Janus Juul Rasmussen – Director for Valcon Design, a mechanical design consulting company with 20 consultants. 16+ years experience developing products and implementing design processes for Audi, Vestas, Grundfos, Novo Nordisk, etc.

Martin Ebro – 10+ years experience as a product and process development consultant at Valcon Design, working with medical devices, automotive equipment, wind turbines, consumer electronics). Currently PhD-researcher at Technical University of Denmark, focusing on Robust Design. Experienced trainer and facilitator of workshops with industry focusing on design processes and product development.

Tobias Eifler – PhD candidate at Darmstadt University, with multiple case studies and workshops with industry.