BMW Robust Design Quest

Multi-objective optimization with modeFRONTIER solves the problem.

hen optimizing crankcase fatigue life and gasket behavior, BMW Motoren Gmbh needed to resolve the problem of noise affecting uncertain variables in the design process.



The engineering team noticed that solutions which performed well at concept level did not pass the validation stage due to unforeseen factors.

To tackle this issue the team considered the uncertainty related to certain input parameters which could not always be precisely determined under real manufacturing and operating conditions. Moreover, a product designed for a specific scenario was not suitable for other environments. Therefore, they looked for a way to come up with designs with a lower variability of performance.

The modeFRONTIER platform provided BMW with the perfect solution: its robust design and multi-objective optimization functionalities, together with powerful integration and process automation tools, proved the winning combination.

The modeFRONTIER Multi-objective Robust Design Optimization (MORDO) tool and modeFRONTIER Response Surface Models (RSM) accelerated the analysis of the entire design process and investigated the noise factors in the vicinity of the best designs.

modeFRONTIER state-of-the-art algorithms addressed the multi-objective optimization challenge by allowing one variable and three constants to be defined as stochastic. During the optimization, the platform automatically created a set of sample designs with a user-specified distribution for each stochastic variable — centered at the initial value point — optimizing their mean values and minimizing their variations. The effective integration approach of the modeFRONTIER workflow editor helped create an automated pipeline connecting the different software packages required to solve the optimization challenge.

By using the RSM approach to run a virtual, robust optimization with thousands of computations and by validating the virtual designs, BMW was able to improve the Fatigue Safety Factor by 15% — a solution which also constrained the variation of the measured output to less than 1%. **DE**

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