

# Robust Sensitivity Analysis using Shapley-Values

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A sensitivity analysis is a common tool for identifying the input variables that have the greatest influence on a result variable of interest. The corresponding sensitivity indices can be determined using a variety of different methods. However, in engineering applications, the following three difficulties arise. First, many model evaluations are required to obtain the indices with a high statistical confidence. Since each individual model evaluation can already take a lot of time and computational resources (e.g., Computational Fluid Dynamics calculations), the number of model evaluations is limited. This leads to sensitivity indices with low confidence. Second, the input variables are often correlated in engineering applications. Third, the model output may be subject to noise, which also affects the sensitivity analysis. These challenges must therefore be overcome.

Shapley-Values are a concept from cooperative game theory and can be used for quantifying the importance of input variables. In this talk, the general properties are discussed. Then, the Shapley-Values are applied on mathematical test function and the results for both uncorrelated and correlated input variables are discussed. In a final example, the Shapley-Values for a turbomachinery test case are computed and the results are compared to the coefficient of importance.