From Allowable Product Tolerance to Acceptable Material Noise: an Inverse Robust Optimization Approach

O. Nejadseyfi[1, a)] , H.J.M. Geijselaers[1, b)] and A.H. van den Boogaard[1, c)]

[1]Nonlinear solid mechanics, Faculty of engineering technology, University of Twente, Enschede, the Netherlands

[a)]Corresponding author: o.nejadseyfi@utwente.nl
[b)]h.j.m.geijselaers@utwente.nl
[c)]a.h.vandenboogaard@utwente.nl

Abstract. Robust optimization is a powerful method to find the parameters for a process at which its output is least sensitive to the variation of the input parameters. In this method, measured or estimated noise parameters are used to estimate the scatter of the output. At the optimum design, the variation in noise parameters leads to a certain minimum scatter of the output. If this minimum scatter of the output does not meet the specified tolerances, then the input noise must be adjusted accordingly. This means for example that materials with a tighter specification must be ordered, which usually incurs additional costs.

In this work, an inverse method is presented to tailor the acceptable variation of noise parameters based on the allowable tolerance in the output. The non-linear behavior of the black-box function, the presence of multiple noise variables, and the interaction between those parameters are the main challenges that are addressed in the inverse problem in this study. This approach has been successfully implemented for a metal forming process. With this method the production engineer can specify allowed scatter of the input parameters during the production stage, such that costs are minimized.