STOCHASTIC SEARCH ALGORITHM FOR DESIGN OPTIMIZATION OF AUTOMOTIVE RUBBER PARTS

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Design optimization is an engineering design methodology using a mathematical formulation of a design problem to support selection of the optimal design among many alternatives [1]. In product design and development cycle, engineers are faced with several predefined requirements which fulfilment is a difficult, time consuming and challenging task. In rubber bumper design one of the most important technical property of the product is the force-displacement curve under compression. This behaviour is the most critical customer need, in many cases its fulfilment requires general iterative design method. Design engineers can handle this task with the modification of the product shape or the modification of the rubber mixture. This kind of shape optimization problem can be solved with several optimization methods, if the parameterization of the design process is determined. Numerical method is a good way to evaluate the working characteristics of the rubber part. Automation of the whole process feasible with the use of Visual Basic for Applications (VBA) which allows to directly access Femap from Excel. Thereby the finite element model pre- and post-processing were controlled with macro running in excel. With the use of these techniques the target function could be evaluated using parameterized finite element analysis. A two-dimensional shape optimization problem was introduced for cylindrical rubber bumper in [2]. For the optimization of the product shape, support vector regression model was used. The aim of this research is to investigate the performance and computational efficiency of stochastic optimization algorithm for the same geometry.

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REFERENCES

[1] Panos Y. Papalambros, Douglass J. Wilde, (2017), *Principles of Optimal Design: Modeling and Computation*, Cambridge University Press, ISBN-13: 978-1107132672
[2] Dávid Huri, Tamás Mankovits, (2019), *Automotive Rubber Part Design Using Machine Learning*, IOP Conference Series: Materials Science and Engineering,659 012022