

On Vehicle Crashworthiness Design Using Structural Optimization

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Akademisk avhandling

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Abstract

This dissertation addresses the problems and possibilities of using structural optimization in vehicle crashworthiness design. The first part of the thesis gives an introduction to vehicle crashworthiness design. The optimization methods presented are also used to exemplify how structural optimization and robustness analysis can be used in vehicle crashworthiness design.

In the second part of the thesis, five papers are appended, where different optimization methods are evaluated and improved for the usage in vehicle crashworthiness design. These papers concern the optimization methods Response Surface Methodology (RSM), Stochastic Optimization (SO) and Space Mapping (SM).

Each method has its advantages and disadvantages. The Response Surface Methodology is the easiest method to use and the method that most often finds the best design of these three methods. Generally RSM is rather expensive, especially when many design variables are used. Then, SO is an effective alternative because in this method the number of evaluations is independent of the number of design variables, which is not the case for RSM. Space Mapping is the cheapest method, because it needs only one or two evaluations per iteration. However, SM is generally a method to find an improved design with fulfilled constraints and sometimes not the absolute optimum solution but to a low cost. Hence, both RSM and SO may produce better designs but at the price of more response evaluations.

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