

Development of an Experiment for Impedance Measurement of Structured Sandwich Sheet Metals by Using a Full Factorial Multi-Stage Approach

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Abstract : Structured sheet metals and structured sandwich sheet metals are three-dimensional, lightweight structures with increased stiffness which are used in the automotive industry. The impedance, a figure of resistance of a structure to vibrations, will be determined regarding plain sheets, structured sheets, and structured sandwich sheets. The aim of this paper is generating an experimental design in order to minimize costs and duration of experiments. The design of experiments will be used to reduce the large number of single tests required for the determination of correlation between the impedance and its influencing factors. Full and fractional factorials are applied in order to systematize and plan the experiments. Their major advantages are high quality results given the relatively small number of trials and their ability to determine the most important influencing factors including their specific interactions. The developed full factorial experimental design for the study of plain sheets includes three factor levels. In contrast to the study of plain sheets, the respective impedance analysis used on structured sheets and structured sandwich sheets should be split into three phases. The first phase consists of preliminary tests which identify relevant factor levels. These factor levels are subsequently employed in main tests, which have the objective of identifying complex relationships between the parameters and the reference variable. Possible post-tests can follow up in case additional study of factor levels or other factors are necessary. By using full and fractional factorial experimental designs, the required number of tests is reduced by half. In the context of this paper, the benefits from the application of design for experiments are presented. Furthermore, a multistage approach is shown to take into account unrealizable factor combinations and minimize experiments.

Keywords : structured sheet metals, structured sandwich sheet metals, impedance measurement, design of experiment

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