KATEDRA MECHANIKI TEORETYCZNEJ I STOSOWANEJ

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Rozprawa doktorska

OPRACOWANIE METODYKI OPTYMALIZACJI KONSTRUKCJI W OPARCIU O ANALIZY WYTRZYMAŁOŚCIOWE POJAZDÓW UŻYTKOWYCH, W SZCZEGÓLNOŚCI NACZEP

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Abstract

The paper presents a methodology for selecting a construction of semi-trailers based on strength analyses. It was created using the five phases of the Six Sigma method and verified on the example of the selection of a frame element for a curtainsider semi-trailer manufactured by Wielton. The work was of an implementation nature and was developed in such a way that it could be applied to the design process at Wielton. After analysing the load condition indicated by the company, potential sources causing damage were identified. The selected research object, which was a curtain-sided semi-trailer, was characterised in detail. The prepared mathematical model of the complete semi-trailer frame was calibrated on the basis of experimental tests. The analysis of the loading condition of the semi-trailer frame carried out on a road simulator has shown that the emergency braking manoeuvre is the most unfavourable loading case. The need to verify the strength of the frame in the situation of the front wall tilt, which occurs during driving, was additionally demonstrated. The methodology was verified on the basis of stereo-mechanical analyses of two other semi-trailer frame structures according to the adopted assumptions. The obtained results corresponded with the results of durability tests carried out on a road simulator of these trailers, which confirmed the correctness of the developed methodology. A parametric model of the corner element was created and then its form was optimised. The main load was the case of emergency braking, described in PN-EN 12642. The aim of the optimisation process was to reduce the stresses in the front corner area of the semi-trailer. This stage, similarly to other analyses, was performed in Ansys environment. As a result, a new structural form of the corner was obtained, reducing stresses in the vicinity of two vulnerable areas. The methodology was implemented at Wielton, and the new component was accepted and sent for internal testing.