

Numerical Study of Leisure Home Chassis under Various Loads by Using Finite Element Analysis

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Abstract : The leisure home industry is experiencing an increase in sales due to the rise in popularity of staycations. However, there is also a demand for improvements in thermal and structural behaviour from customers. Existing standards and codes of practice outline the requirements for leisure home design. However, there is a lack of expertise in applying Finite Element Analysis (FEA) to complex structures in this industry. As a result, manufacturers rely on standardized design approaches, which often lead to excessively engineered or inadequately designed products. This study aims to address this issue by investigating the impact of the habitation structure on chassis performance in leisure homes. The aim of this research is to comprehensively analyse the impact of the habitation structure on chassis performance in leisure homes. By employing FEA on the entire unit, including both the habitation structure and the chassis, this study seeks to develop a novel framework for designing and analysing leisure homes. The objectives include material reduction, enhancing structural stability, resolving existing design issues, and developing innovative modular and wooden chassis designs. The methodology used in this research is quantitative in nature. The study utilizes FEA to analyse the performance of leisure home chassis under various loads. The analysis procedures involve running the FEA simulations on the numerical model of the leisure home chassis. Different load scenarios are applied to assess the stress and deflection performance of the chassis under various conditions. FEA is a numerical method that allows for accurate analysis of complex systems. The research utilizes flexible mesh sizing to calculate small deflections around doors and windows, with large meshes used for macro deflections. This approach aims to minimize run-time while providing meaningful stresses and deflections. Moreover, it aims to investigate the limitations and drawbacks of the popular approach of applying FEA only to the chassis and replacing the habitation structure with a distributed load. The findings of this study indicate that the popular approach of applying FEA only to the chassis and replacing the habitation structure with a distributed load overlooks the strengthening generated from the habitation structure. By employing FEA on the entire unit, it is possible to optimize stress and deflection performance while achieving material reduction and enhanced structural stability. The study also introduces innovative modular and wooden chassis designs, which show promising weight reduction compared to the existing heavily fabricated lattice chassis. In conclusion, this research provides valuable insights into the impact of the habitation structure on chassis performance in leisure homes. By employing FEA on the entire unit, the study demonstrates the importance of considering the strengthening generated from the habitation structure in chassis design. The research findings contribute to advancements in material reduction, structural stability, and overall performance optimization. The novel framework developed in this study promotes sustainability, cost-efficiency, and innovation in leisure home design.

Keywords : static homes, caravans, motor homes, holiday homes, finite element analysis (FEA)

Conference Title : ICCAPDEA 2023 : International Conference on Computer-Aided Product Design and Engineering Applications

Conference Location : London, United Kingdom

Conference Dates : September 18-19, 2023