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DESIGN OF AN INTERMODAL FREIGHT WAGON USING MULTIOBJECTIVE OPTIMIZATION

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Summary: The growing demand for environmentally friendly transportation is increasing the focus on railway, both for passengers and freight. The latter is expected to become more efficient and more resilient to keep up with the increasing necessity. One such way of increasing efficiency, and potentially reliability as well, is to design lighter freight wagons leveraging modern engineering techniques, namely design optimization.

Decreasing the weight of a freight wagon while keeping its structural performance and behavior – maintain or lowering the structure's compliance with a lower mass, when compared with older vehicles – is paramount to increasing sustainability by allowing the transport of a larger payload with the same energy cost. This study employs design optimization on an Sggrss freight wagon to reduce its mass while keeping or decreasing the structure's compliance.

The discreet Direct MultiSearch method (DMS) is employed as the optimization algorithm and Nastran as the Finite Element solver for the structural dimensioning of the wagon platform. This type of structure, built using sheet metal construction techniques, lends itself to the use of multiobjective optimization by targeting the positioning of some of its structural members, their thicknesses and other associated dimensions. The design of the wagon is guided by the applicable European standards for the construction and dimensioning of freight wagons since it is expected to circulate and be commercialized in Europe.

The final structure of the wagon presents a lower weight when compared to other wagons currently in operation and similar mechanical performance, while still meeting the requirements present in the European standards.