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PASSENGER ROLLING STOCK FRONTAL CRASH ANALYSIS

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Summary: Crashworthiness is one of the fundamental requirements in the design of rail passenger rolling stock. This study presents a numerical simulation of a frontal crash between a driving car and a freight wagon, focusing on evaluating structural integrity, crashworthiness, and regulatory compliance. To provide context, the regulatory framework that governs the crashworthiness of rail passenger vehicles, specifically EN 15227, is reviewed, and a theoretical overview is performed. The theoretical foundation includes impact mechanics, material behavior, energy absorption mechanisms, and the explicit finite element method. The study introduces criteria for assessing crashworthiness and defines key performance indicators, including deformation, energy dissipation, and deceleration levels. A comprehensive finite element model is developed, incorporating geometric and material properties, mesh quality and definition, contact interactions, and failure criteria. The case study outlines loading conditions and boundary constraints based on real-world crash scenarios. Simulation results illustrate deformation patterns, force-time histories, and energy dissipation mechanisms during the collision.
The Anti-climber, which acts as the main energy absorber, undergoes further analysis. These results are compared with established crashworthiness criteria to assess compliance and identify potential design enhancements. Ultimately, the study provides valuable insights into the structural performance of rail. vehicles in frontal impacts, contributing to the advancement of safer railway transportation systems.