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NUMERICAL ANALYSIS OF VEHICLE LOADS USING MATLAB

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Abstract

Vehicles traveling across the bridge can have a substantial influence on driving safety and the structural integrity of the bridge itself. High-speed vehicles can exert a significant impact on the structure, thereby affecting its operational condition and lifespan. For human and environmental well-being is a critical situation, as failures can have disastrous consequences for lives, property, and ecosystems. The interaction between bridges and vehicles is a critical area of study. As the industry continues to grow, different methods are now available to study this interaction. The focus of the study is a numerical analysis with Matlab concerning the vehicle-bridge coupling system, utilizing the fundamental theory of vehicle-bridge-coupled vibration. The paper derives the differential equation governing the vehicle-bridge-coupled system. This research studies the bridge's dynamic characteristics under various weights and speeds, utilizing a simply supported beam as an example study. Using Matlab software, numerical analyses are conducted to determine displacement values for different bridge loading scenarios. The analysis aims to highlight the bridge displacement by applying speed regulations from Romania. Utilizing the acquired results, the constructor can make informed decisions by imposing limitations on vehicle mass and speed for bridge traversal. This prioritizes bridge safety, ensuring the integrity of transportation networks and minimizing environmental repercussions. This study is one of the first to incorporate Romanian regulations on vehicle speed and mass limits into this type of analysis, offering a valuable contribution to the field.

Key words: displacement, numerical method, vehicle-bridge coupling, vehicle mass, vibration

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