

MODEL UPDATING OF A HISTORIC RAILWAY BRIDGE BASED ON GENETIC ALGORITHMS

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This article describes the calibration of a finite element numerical model that simulate the dynamic behaviour of a historic metallic railway bridge that is part of Tâmega Line, which is a deactivated line of the Portuguese Railways since 2008.

The updated numerical model of the bridge is reported to its present condition serving as a basis for subsequent studies/projects on its structural strengthening, therefore promoting for the sustainability and cost-effectiveness of future interventions in terms of materials and human resources required.

The geometry of the numerical model was defined based on data collected from laser geometric surveys and visual inspections, which have allowed identifying the existent signs of structural damage and deterioration.

With respect to the acquisition of field data concerning the bridge structural response, an ambient vibration test was carried out in order to characterize the natural frequencies and the configurations of global vibration modes.

The calibration of the bridge's numerical model relies on the application of an iterative method based on a genetic algorithm. This method involves the resolution of an optimization problem, which requires the minimization of an objective function by varying a set of preselected model parameters. The results obtained with the calibration process have shown a very good agreement between numerical and experimental modal responses and an improvement of the numerical model regarding its base pre-calibrated phase. Moreover, the stability of a significant number of parameters, considering different initial populations, proved the robustness of the genetic algorithm for the optimization of the numerical models.