

## Resonance and cancellation phenomena of simply supported partially clamped beams: application to bridges with ballasted track.

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**Abstract:** Since the development of new railway lines of high speed; the dynamic response of bridges constitutes a subject interest of researchers and engineers; several Scientifics have investigated the resonance phenomena in railway bridges; resonance phenomena occur as the excitation frequency coincide with the proper frequency of the bridge. In this work the dynamic behavior of beams leaning on identical rotational springs subjected to the circulation of moving loads at constant speeds is investigated. The free vibration response of the beam when traversed by a single load is obtained analytically and the conditions for maximum response and cancellation in free vibration are derived and interpreted. Then the response of the simply supported partially clamped (SSPC) beam under series of equidistant loads is addressed focusing in the possibility of exciting resonance situations of the former for particular traveling velocities. Equating the conditions for resonance of a particular beam with that of maximum free response and cancellation under a single load, ratios of the bridge length and train characteristic distances leading to resonances of remarkable amplitudes or, contrarily, cancelled resonances are obtained. The possibility to predict both situations could be of especial interest in the set up of dynamic tests in experimental campaigns performed on High-Speed railway bridges.

**Keywords:** resonance, cancellation, high railway bridge, partially clamped beam

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