Congress on Numerical Methods in Engineering
Lisboa, June 29 to July 02, 2015

RESUMO N° 122

SOIL-STRUCTURE INTERACTION EFFECTS ON THE TRANSVERSE RESPONSE OF BEAM BRIDGES UNDER MOVING LOADS AND ITS APPLICATION TO RAILWAY TRAFFIC

Alejandro Doménech, domeneca@uji.es
Universitat Jaume I, Mechanical Egineering and Construction Department, Spain

Antonio Romero Ordóñez, aro@us.es
Universidad de Sevilla, Escuela Técnica Superior de Ingeniería, Spain

Maria D. Martínez-Rodrigo, mrodrigo@uji.es
Universitat Jaume I, Mechanical Egineering and Construction Department, Spain

Pedro Galvín Barrera, pedrogalvin@us.es
Universidad de Sevilla, Escuela Técnica Superior de Ingeniería, Spain

Keywords: Soil-Structure Interaction, Moving Loads, Railway Bridges, Coupled Bem-Fem Model, Maximum Free Vibration, Cancellation

This paper describes a research work on the dynamic behaviour of beams traversed by moving loads including soil-structure interaction effects. The main application of the study is the analysis of the transverse vibratory response of railway bridges, taking into account the interaction of the substructure with the soil when the super-structure may experience resonant conditions, and undergo considerably high levels of transverse accelerations. As this phenomenon is highly influenced by the free vibration response induced by each axle load, a numerical investigation is carried out analyzing the effects of the wave propagation problem on the free vibration response of beams under moving loads. To this end a coupled three-dimensional boundary element-finite element model formulated in the time domain is used to reproduce the soil and structural behaviour, respectively. A subset of bridges is defined considering span lengths ranging from 12.5 to 25 m, and fundamental frequencies covering existing deck typologies in this span length interval. As for the soil properties, a homogeneous half-space is considered with shear wave velocities ranging from 80 to 365 m/s. In these scenarios, preliminary conclusions are derived regarding the conditions of maximum free vibration and cancellation of the response under a moving force, and how these are affected by the soil properties. This information will be used in a second phase of the investigation to predict how the acceleration response of the bridge deck at resonance is modified by the soil conditions in the case of bridges traversed by trains of loads. In this paper the approach adopted is justified, a parametric analysis is designed and preliminary results are shown.