DYNAMIC IDENTIFICATION AND TESTING, MODELLING AND DESIGN OF SHAKING TABLE TEST FACILITIES

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The research group is involved in the experimental study of the dynamic behavior of civil structures. The problem is particularly relevant because from the dynamic characterization of the system (modes, natural frequencies, damping), the most plausible values of the main parameters governing the numerical models able to simulate the behavior of the structure can be defined by identification techniques.

The study can be split in different topics: set-up of experimental tests, determination of the dynamic characteristics of the structure and processing of data to estimate unknown parameters of models such as stiffness and mass of the system (model updating). Within the first topic, different types of structures such as hospitals, schools, bridges, railway bridges and pedestrian bridges were considered. The tests were carried out either using a forced excitation or environmental excitation (wind, traffic). Both conventional instrumentation and low-cost accelerometers (MEMS) were used. Frequencies, modal deformation and damping were then identified by using methods defined in the frequency domain and in the time domain, such as circle fit, ARMA, ARMAV, Lissajous diagrams and coupled time-frequency methods such as wavelet transforms. Moreover, also output-only modal identification techniques were investigated.

With regard to shake table testing, the activity regarded mainly the development of an analytical/numerical model of the dynamic functioning of the shaking table capable of effectively capturing its actual behaviour. This model revealed to be very useful for: (a) the design project of new shaking tables, (b) for their adjustments, and (c) for the study devoted to the minimisation of the interactions between the table itself and the testes structures. Recently the research group planned, designed and directed two experimental shaking-table test campaigns: (1) tests on a full-scale 3-storey building structure realized with sandwich r.c. panels, at the EUCENTRE Lab in Pavia; (2) tests on scaled models of flat-bottom silos containing grain –like materials, at the EQUALS Lab in Bristol (UK).

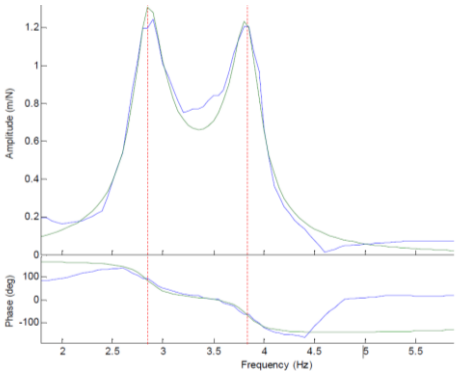

Fig. 1. Identification of the natural frequencies (Landi).

Fig. 2. Forced vibration test on pedestrian bridge (Diotallevi).

Fig. 3. Tests on a full-scale 3-storey building realized with RC sandwich panels, at the EUCEN-

TRE Lab in Pavia (Silvestri).

MAIN PUBLICATIONS

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RESEARCH PROJECTS

2009-2012: Research Project FADLESS (Fatigue damage control and assessment for railway bridges), sponsored by European Commission within program RFCS (Research Fund for Coal and Steel-FP7); partners of the projects are: PISA ricerche, Riva Acciaio, VCE Holding, K. U. Leuven, LMS International NV, Bauhaus Universitat Weimar, Facultade De Engenharia Da Universitade Do Porto, University of Bologna.

2010-2012: SERIES Research Projects:
- "Seismic behavior of structural systems composed of cast in situ concrete walls", EUCENTRE TREES Lab Facility (Pavia, Italy), Lead User: Prof. Salvador Ivorra Chorro, Univ. of Alicante, Resp. Unit of Bologna: Prof. Tomaso Trombetti.
- "Assessment of the seismic behaviour of flat-bottom silos containing grain-like materials", EQUALS Laboratories (Bristol, UK), Lead User: Prof. Dora Foti, Politecnico di Bari, Resp. Unit of Bologna: Prof. Tomaso Trombetti.

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