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A simplified procedure for mass and stiffness estimation of existing structures

Antonella Nigro, Rocco Ditommaso, Felice Carlo Ponzo, and Domenico Salvatore Nigro
University of Basilicata, School of Engineering, Potenza, Italy (felice.ponzo@unibas.it)

This work focuses the attention on a parametric method for mass and stiffness identification of framed structures, based on frequencies evaluation. The assessment of real structures is greatly affected by the consistency of information retrieved on materials and on the influence of both non-structural components and soil. One of the most important matter is the correct definition of the distribution, both in plan and in elevation, of mass and stiffness: depending on concentrated and distributed loads, the presence of infill panels and the distribution of structural elements.
In this study modal identification is performed under several mass-modified conditions and structural parameters consistent with the identified modal parameters are determined. Modal parameter identification of a structure before and after the introduction of additional masses is conducted. By considering the relationship between the additional masses and modal properties before and after the mass modification, structural parameters of a damped system, i.e. mass, stiffness and damping coefficient are inversely estimated from these modal parameters variations. The accuracy of the method can be improved by using various mass-modified conditions.
The proposed simplified procedure has been tested on both numerical and experimental models by means linear numerical analyses and shaking table tests performed on scaled structures at the Seismic Laboratory of the University of Basilicata (SISLAB). Results confirm the effectiveness of the proposed procedure to estimate masses and stiffness of existing real structures with a maximum error equal to 10%, under the worst conditions.

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