Online/offline dynamic substructuring methods for the seismic characterization of coupled tank-piping system response

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INVITED SESSION: COUPLED PROBLEMS WITH NUMERICAL AND PHYSICAL SUBDOMAIN INTERACTIONS

ABSTRACT

Successful online heterogeneous (numerical/physical) dynamic substructuring simulations (HDS) have shown their tremendous potential for efficient realistic dynamic analysis of almost any type of non-linear structural system. Moreover, owing to faster and more accurate testing equipment, a number of different offline experimental substructuring methods, operating both in time (e.g. the impulse-based substructuring, IBS) and frequency domains, have been employed in mechanical engineering to examine dynamic substructural coupling. Numerous studies have dealt with the above-mentioned methods and with the consequent uncertainty propagation issues, either associated with experimental errors or modeling assumptions. Nonetheless, a limited number of publications have systematically cross-examined the performance of the various substructuring methods and the possibility of their exploitation in a complementary way to expedite a hybrid experiment/simulation. In this paper, we compare the performance of these methods including standard time integration schemes and the coupling algorithm of subdomains, based on an advanced parallel finite element tearing interconnecting algorithm. Moreover, we include typical random uncertainties emerging from experimental measurements and operators, which are important for the practical implementation of the analysed methods.

This paper is an extension of [1] and investigates also coupling effects using various tank configurations and a reference piping system [2]. The main results and comparisons, based on a series of Monte Carlo simulations and HDS identify pros and cons of the aforementioned testing methods.

REFERENCES

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