Project Name: ANR MODULATE - *Modeling long period ground motions, and assessment of their effects on large scale infrastructures*

Work Package 5: Seismic Reliability of Large-Scale Infrastructures

Duration: 20 months (01/01/2021 - 30/06/2022)

Milestones: Development of novel Incremental Dynamic Analysis methods and fragility curves for long-period structures with account of effects of surface waves

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Seismic Reliability of Large-Scale Infrastructures

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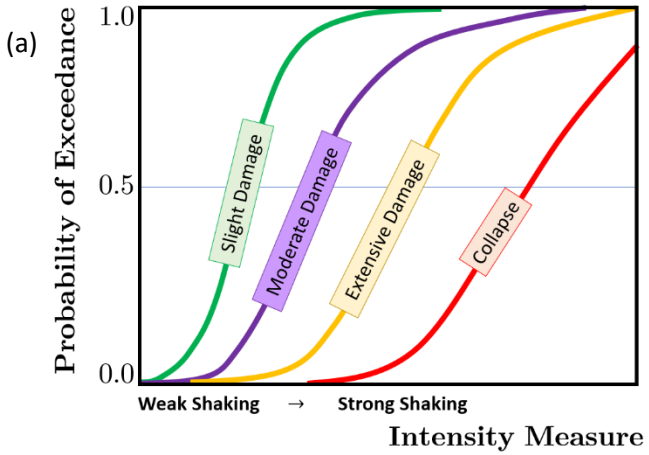
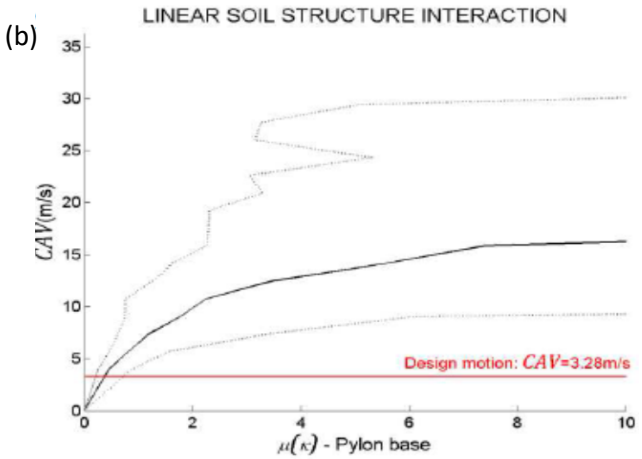
Overview

Within the ANR Project MODULATE, the 5th and last work package (WP5) is concerned with the study of Seismic Reliability of large-scale infrastructure. The scope of WP5 is to exploit results from previous WPs for developing a rigorous basis for reliability assessment and fragility analysis of large-scale infrastructure. WP5 aims further at interpreting the above developments for proposing a set of realistic guidelines for quantifying the effects of surface waves on seismic design. The WP includes two tasks: a) Vulnerability assessment of structures subjected to surface waves, b) Recommendations for seismic risk assessment of large-scale structures subjected to surface waves. WP5 culminates to novel fragility curves for long-period structures and to practical guidelines for quantifying the effects of surface waves destined to practicing earthquake engineers.

Objectives

- Exploit results from surrogate and detailed models for a rigorous reliability assessment of large-scale infrastructures
- Create novel methodologies for the construction of fragility curves that take into account the dispersive nature of surface waves
- Adapt existing Incremental Dynamic Analysis methodologies for record sets, intensity and damage measures relevant to long-period structures and motions enriched with surface waves
- Propose realistic guidelines for the effects of surface waves on applied seismic design

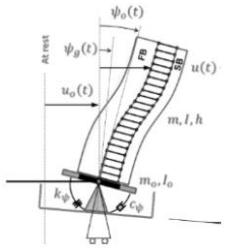




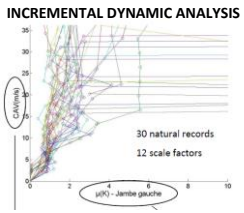
Typical examples of: a) fragility curves and b) results of IDA for bridge piers with linear SSI (Godoy et al. 2012)

Strategy

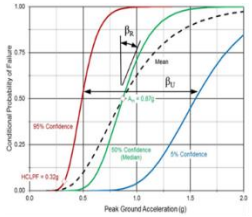
Analysis of results from previous WPs for the identification of long-period structure configurations that are vulnerable to effect of surface waves



Development of correlations between the nonlinear structural response (as obtained with surrogate and detailed models) to ground motion excitation



Implementation of novel methods in the context of Incremental Dynamic Analysis (IDA) methodology for probing the evolution of specific performance criteria in large-scale infrastructures / Comparisons of IDA curves between surface-wave compatible and conventional ground motions



Development of novel fragility curves for long-period structures with consideration of surface wave effects

Development of recommendations for modifications to current design methodologies for buildings, tanks and bridges to include the effects of surface waves

Quantification of seismic margins required for the detrimental basin effects and comparison with normative safety factors

Proposals and recommendations for revision and enrichment of applicable design norms

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