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FINITE ELEMENT UPDATING OF A BRIDGE MODEL USING OPERATIONAL MODAL ANALYSIS

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Abstract. Operational Modal Analysis (OMA) consist in finding the dynamic characteristic of a structure through its modal parameters using output-only signals. Differently from the classical approach of Experimental Modal Analysis (EMA), where the input signal are also measured, OMA only uses the stochastic nature of the inputs, assumed to be random due the ambient conditions. An important application of this technique appears in the model validation, where numerical and experimental results are compared (Brincker and Ventura, 2015).Because of the large size of bridges, the identification of this kind of structures are restricted to operational modal analysis. Output-only methods are necessary since a controlled input is usually hard and expensive to apply. Also, the ambient forces such as wind, waves, traffic and ground motion can notbe eliminated. The advantage of OMA when compared to EMA is that those forces do not need to be measured and quantified.In this paper, the stochastic subspace identification method is used to characterize the dynamic behavior of a small bridge model under wind load (Overschee and Moor, 1996)(Wagner et al., 2017). The identified natural frequencies and mode shapes are used to validate its finite element model, specially regarding the imposed boundary conditions (clamp-clamp). In reality, those conditions are uncertain and need to be taken into account to improve the predictability of the model (Ritto et al., 2008)(Ritto et al.,2016). The clamp condition is changed into a free condition with displacements and torsional linear springs, where the uncertainties parameters are the respective stiffnesses.