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Improved bridge evaluation through finite element model updating using static and dynamic measurements

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Abstract

The potential of combining finite element (FE) analysis with on-site measurement through finite element model updating is indisputable. However, simplified initial models and too few measurements can lead to updated model parameters which conceal inaccurate modelling assumptions rather than improve estimates of the actual structural parameters. Therefore, the methodology proposed aims primarily to eliminate inaccurate modelling simplification by means of manual model refinements before parameters are estimated by non-linear optimization. In addition, multi-response objective functions are introduced, which allow combing different types of measurements to obtain a solid basis for parameter estimation. The proposed methodology was applied to one of the worldâ€™s largest single-arch bridges, the new Svinesund Bridge, and disclosed a need to use a non-linear model in order to estimate the structural parameters more

accurately. The resultant model could reproduce the measurements with significantly improved accuracy without assigning unrealistic values to model parameters.

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Keywords

Model updating; Parameter estimation; Structural identification; System identification; Multi-response; Finite element method

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