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Assessment of Numerical Prediction Models for Aeroelastic Instabilities of Bridges

The phenomenon of aerodynamic instability caused by the wind is usually a major design criterion for long-span cable-supported bridges. If the wind speed exceeds the critical flutter speed of the bridge, this constitutes an Ultimate Limit State. The prediction of the flutter boundary, therefore, requires accurate and robust models. The complexity and uncertainty of models for such engineering problems demand strategies for model assessment. This study is an attempt to use the concepts of sensitivity and uncertainty analyses to assess the aeroelastic instability prediction models for long-span bridges. The state-of-the-art theory concerning the determination of the flutter stability limit is presented. Since flutter is a coupling of aerodynamic forcing with a structural dynamics problem, different types and classes of structural and aerodynamic models can be combined to study the interaction. Here, both numerical approaches and analytical models are utilised and coupled in different ways to assess the prediction quality of the coupled model.

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