

Synergistic Framework for Analysis and Model Assessment in Bridge Aerodynamics and Aeroelasticity

Wind-induced vibrations often represent a major design criterion for long-span bridges. This work deals with the assessment and development of models for aerodynamic and aeroelastic analyses of long-span bridges. Computational Fluid Dynamics (CFD) and semi-analytical aerodynamic models are employed to compute the bridge response due to turbulent and laminar free-stream. A comparative methodology is introduced for qualitative and quantitative model assessment, based on Category Theory and comparison metrics for time-histories, respectively. Moreover, two advances on the CFD front are presented, including a Turbulent Pseudo-3D Vortex Method and a method for determination of the complex aerodynamic admittance. The applications include both fundamental examples and practical case studies.

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