

AWind – A MATLAB-based integrated platform for dynamic and aeroelastic analyses of structures

Abstract

AWind is a MATLAB-based integrated platform for dynamic and aeroelastic analyses of structures. The code was developed by Igor Kavrakov as a part of his on-going PhD project, supervised by Prof. Dr. Guido Morgenthal. The principal objective of the code is to enable computation of flutter and buffeting analyses of long-span bridges by utilizing a multitude of aerodynamic models. In addition, it offers dynamic analyses for a wide range of time-dependent excitation. The code has been verified in the scope of the Task Group 3.1 of the International Association of Bridge and Structural Engineering (IABSE): “Super-long-span Bridge Aerodynamics”. Beyond research-related purposes, it has been utilized for practical applications as well. It is easily coupled with most of the commercial Finite Element softwares. Some of the features provided by the code include:

- Multimode dynamic analyses in state-space or standard second-order differential equation of motion for user input dynamic characteristics
- Buffeting and flutter analyses for a multitude of time-domain aerodynamic force models including quasi-steady, linear unsteady, hybrid nonlinear, etc.
- Comfort and accident analyses for vehicles during wind-vehicle-bridge interaction
- Analyses for serviceability limit state for random pedestrian loading
- Passive control utilizing tuned mass dampers
- Post-processing tools including visualisation

Related projects

Some of the structures for which the code has been applied include:

Storebelt Bridge, Kruunuvuori Bridge, Fourth Panama Canal Bridge, Mersey Gateway Crossing, Danjiang Bridge, Pylonbrücke Alte Elbe, Stonecutters Bridge

Collaboration

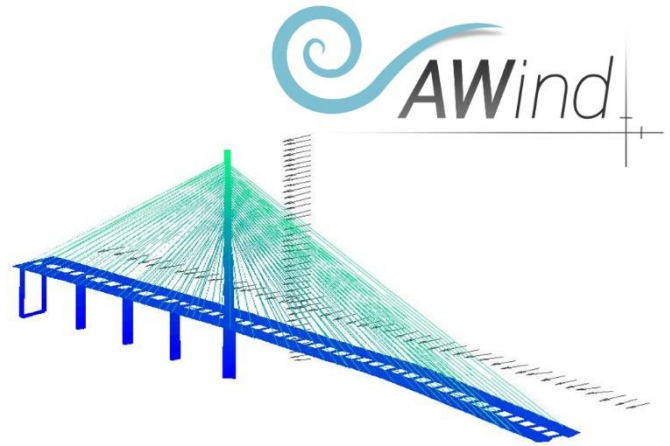
City, University of London, Department of Civil Engineering (Dr. Alfredo Camara)

Contact person

Igor Kavrakov

Tel.: +49 3643 584109

E-Mail: igor.kavrakov@uni-weimar.de



Buffeting response of Stonecutters bridge at erection stage

Related publications:

1. Kavrakov, I., Morgenthal, G., Comparative Assessment of Aerodynamic Models for Buffeting and Flutter of Long-span Bridges, *Engineering 3* (2017), pp. 823–838
2. Kavrakov, I., Morgenthal, G., Aeroelastic analyses of bridges using a Pseudo-3D vortex method and velocity-based turbulence generation, *Engineering Structures*, 176 (2018), pp. 825-839
3. Kavrakov, I., Morgenthal, G., A Synergistic Study of a CFD and Semi-analytical Models for Aeroelastic Analysis of Bridges in Turbulent Wind Conditions, *Journal of Fluids and Structures*, 82 (2018), pp. 59–85
4. Diana, G., Stoyanoff, S., [and 14 others, including Kavrakov, I.], 2018. Super-long span bridge aerodynamics: First results of the numerical benchmark tests from Task Group 10, 40th IABSE Symposium, Nantes, 2018 (Part of IABSE TG3.1)
5. Kavrakov, I., Camara, A., Morgenthal, G., Influence of aerodynamic model assumptions on the wind-vehicle-wind interaction, 19th Congress of IABSE, Stockholm, 2016
6. Kavrakov, I., Morgenthal, G., Modeling techniques for buffeting analysis of long-span bridges, IABSE Conference, Guangzhou, 2016
7. Kavrakov, I., Tolba, K. I., Morgenthal, G., Comparative study of semi-analytical and numerical methods for aerodynamic analysis of long-span bridges, 8th International Colloquium BBAA, Boston, 2016