Numerical wind tunnel for aerodynamic and aeroelastic characterization of bridge deck sections and comparison with experimental results

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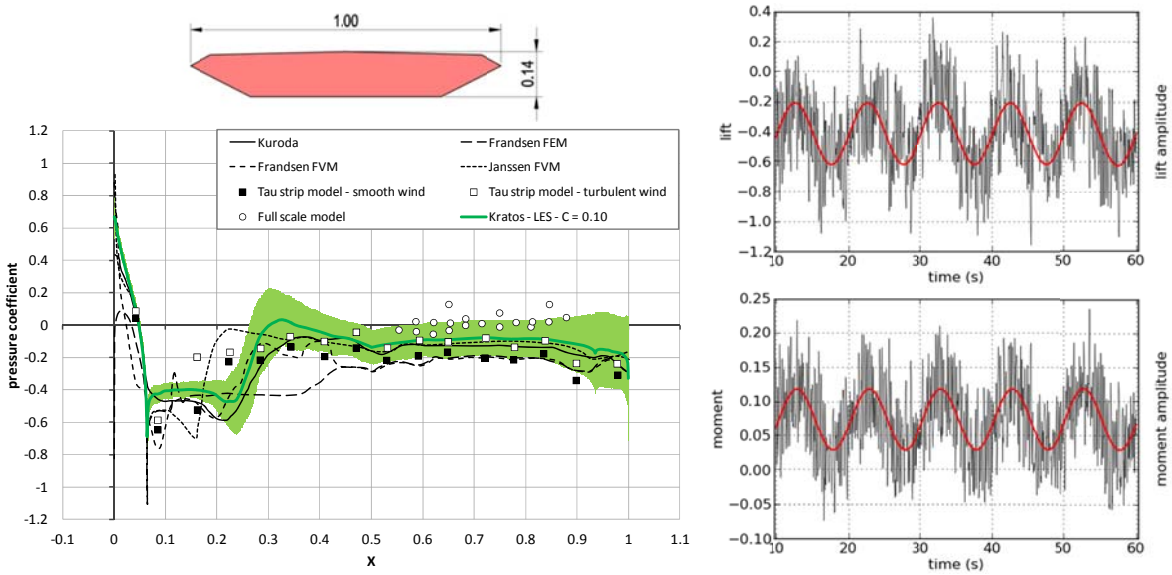
ABSTRACT

The aim of the present study is to propose a reliable engineering procedure to analyze bridges subjected to wind loads thanks to numerical simulations by-passing the expensive wind tunnel tests.

Simulations exploit Kratos [1], a free multi-physic FEM code developed at CIMNE in Barcelona, and, specifically, an adaptation to the long-span bridge case of its numerical tool for analyses of in-wind ultra-lightweight structures developed within the uLites project [2].

Time histories of the forces induced by the wind flow are used to calculate aerodynamic and aeroelastic parameters for the sections of Great Belt Bridge (Denmark) and of the bridge on A31 highway over Adige river (Italy). Both static analyses (CFD procedure with fix boundaries) and imposed-displacements analyses (CFD with arbitrary eulerian-lagrangian approach on moving mesh) give results comparable with those coming from wind tunnel testing and from literature [3]. Results manifest regular trends and values little influenced by CFD setting, proving the reliability of the proposed procedure.



REFERENCES

[1] Kratos multi-phisics web pages, http://www.cimne.com/kratos/

[2] ULites project supported by the Research Executive Agency in the Seventh Framework Programme of the European Union, SP4-Capacities, Research for the benefit of SMEs, FP7-SME-2012 GA-314891, http://www.cimne.com/websasp/ulites/

[3] Bruno L., "The validity of 2D numerical simulation of vertical structures around a bridge deck", *Mathematical and Computer Modeling*, (2002)