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Aeroelastic-structural coupling in antenna prototype for windy open-space

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ABSTRACT

The interaction between wind and an antenna prototype for the low-frequency radio telescope of the Square Kilometer Array (SKA) is experimentally tested in the wind tunnel of the Politecnico di Torino.The tests aim to predict the antenna behaviour during working conditions, i.e. mounted by means of five contact points to a metal grid on sandy ground in the Australian desert.

The wind tunnel is characterised by a circular test section having a diameter equal to 3 m and a length equal to 5 m. The height and the distance between the lateral legs of the antenna are equal respectively to 2.2 m and 1.5 m. The tests were performed at increasing wind speed up to 110 km/h. The system under analysis is an aluminium antenna composed by four parts arranged in axial symmetry and each one made of fifteen rods and small plates/wire elements.

A numerical parametric model of the system is preliminary used to understand the frequency range of interest. The model is able to handle very high modal density and closed spaced modes in multiplicity of four because of the symmetric structure. The experimental results emphasise the fluid-structure coupling of aerodynamics modes and the critical aspects of the boundary conditions for a good prediction of the oscillations amplitudes.

Keywords: wind tunnel, experimental fluid-structure interaction, coincident eigenvalues, high-density modal content.