Numerical simulation of an inflated structure for an aircraft hangar

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Abstract

BuildAir S.A. has projected and built the H75 hangar in Jeddah (Saudi Arabia) for aircraft storage and maintenance tasks. The hangar is mainly conceived as a set of inflatable tubes where the stiffness is provided by the internal pressure. The stability of the whole structure is assured by a textile straps network surrounding the inflated that transmit the forces to the ground by means of anchoring plates. H75 is the largest inflatable hangar ever projected by BuildAir.

From the structural point of view, the whole structure is composed by three parts: the main body where the aircraft is placed and two enclosures to ensure the functionality of the hangar. The structural analysis and design of this structure involves complex structural concepts due to the specificity of the structural elements employed like membranes, straps or cables, which make the problem highly non-linear, and so, a numerical approach is reclaimed to predict the structural behavior of the hangar in front of the projected loads.

Structural hypothesis are assumed in relation with the geometry of the elements, or the mechanical response of the materials. Numerical assumptions are also considered to reach a stable solution for the structural problem.

In this paper, the numerical simulation of the hangar and its structural units is presented as well as some structural and numerical conclusions and/or recommendations coming out from the work developed in the H75 structural analysis.

Uncertainties about the loads are one of the main items of the project. The main action over the hangar is the wind load. The lack of standards for wind loads over this type of structures lead toe European norms to be used as reference, although it means an oversized pressure distribution over the hangar. For this reason, a coupled fluid-structure numerical simulation has been considered, using a Panel Method approach for the fluid to improve the knowledge about the real wind loads. Preliminary results for some inflatable structures are also presented.

References

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