

Collapse Analysis of Wind Turbines Using a Scheme of Fluid-Structure Interaction

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ABSTRACT

Wind turbines are a real alternative for clean power generation aimed at reducing global warming and improving sustainable energy. To withstand wind forces, aerogenerators should be properly analyzed to ensure a good operation in the system lifetime. Several approaches can be established to perform analysis and design of this kind of structures. However, wind turbines have collapsed all around the world, and a reason for its failure is still being searched.

In this paper, an engineering solution considering fluid structure interaction for wind turbines is presented, aiming to find why wind turbines collapse. Wind action is modelled through a stabilized fluid flow formulation, while the structure is solved with geometrically nonlinear shell elements with only translation degrees of freedom. In both cases (i.e., the modelling of the fluid as well as the structure), the finite element method is used to find a solution.

The main result found in this study is the location of principal stresses in the structure due to dynamic wind action. It is concluded that most of the times failure of wind turbines will not occur in its base as it is usually believed.

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