Parametric investigation of the soil–structure interaction effects on the dynamic behaviour of a shallow foundation supported wind turbine considering a layered soil

The proposed investigation is concerned with influential factors of soil–structure interaction issues for onshore wind turbines. Indeed, the awareness of these aspects encounters hardly a straightforward application in practical regulations and therefore is often neglected. However, with the rapid recent growth, the wind energy installations are expanding into regions where the soil conditions may be unfavorable. A consciousness raising of the significance of interaction between the wind turbine, its foundation and the underlying soil is lacking. This paper aims to fill this research gap.

It involves a three-blade wind turbine grounded on a layered half space. The layered soil is simplified as a horizontal layer over an homogeneous half space. However, the method can consider multilayered soil and different bottom conditions, such as rigid bedrock or flexible half space. The soil–structure system is modeled by means of a coupling between finite element and boundary element method. The analysis is carried out in frequency domain. At the first stage, the only foundation–soil system is investigated, and subsequently, the focus shifts to the whole turbine-soil assembly. The effects of different parameters are systematically evaluated, in order to provide a range of values for which the soil–structure interaction has to be accounted for. The investigation highlighted the
importance of the relative stiffness of structure and soil. Also, the ratio of the layer stiffness to the half space stiffness plays an important role. Copyright © 2014 John Wiley & Sons, Ltd.

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