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DYNAMIC ANALYSIS AND UNCERTAINTY QUANTIFICATION IN GUYED SUPPORT STRUCTURES FOR WIND TURBINES

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Abstract. The advance in the research for improved forms of energy generation with minimal impact on the environment has a strong branch on wind energy generation. To access better quality winds (less turbulent) to enhance energy production, there are two main solutions: higher support structures or moving the generator offshore. The first solution has material and economical limits, since the support structure usually consists of a steel tubular column (known as monopile). A solution to this problem, which is being developed by major wind turbine manufacturers, is to use guyed columns instead of monopiles. This article outlines the dynamic behavior and propagation of uncertainties in a guyed support structure for an onshore wind turbine (OWT). An efficient 3D finite element model that considers the geometric nonlinearities of the guys was developed to evaluate the dynamic response of guyed structures. To evaluate the structural response, the mean wind velocity and the initial tension of the guys are considered stochastic variables. The wind load record on the column is also generated as a stochastic process. The displacements of the tip of the column are then analyzed using deterministic and statistic tools to evaluate the structural response.