World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:15, No:12, 2021

Reliability-based Condition Assessment of Offshore Wind Turbines using SHM data

Authors : Caglayan Hizal, Hasan Emre Demirci, Engin Aktas, Alper Sezer

Abstract : Offshore wind turbines consist of a long slender tower with a heavy fixed mass on the top of the tower (nacelle), together with a heavy rotating mass (blades and hub). They are always subjected to environmental loads including wind and wave loads in their service life. This study presents a three-stage methodology for reliability-based condition assessment of offshore wind-turbines against the seismic, wave and wind induced effects considering the soil-structure interaction. In this context, failure criterions are considered as serviceability limits of a monopile supporting an Offshore Wind Turbine: (a) allowable horizontal displacement at pile head should not exceed 0.2 m, (b) rotations at pile head should not exceed 0.5°. A Bayesian system identification framework is adapted to the classical reliability analysis procedure. Using this framework, a reliability assessment can be directly implemented to the updated finite element model without performing time-consuming methods. For numerical verification, simulation data of the finite model of a real offshore wind-turbine structure is investigated using the three-stage methodology.

Keywords : Offshore wind turbines, SHM, reliability assessment, soil-structure interaction
Conference Title : ICSCHM 2021 : International Conference on Structural Control and Health Monitoring
Conference Location : Vienna, Austria
Conference Dates : December 27-28, 2021