EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1166

FINITE ELEMENT MODEL UPDATING OF A WIND TURBINE BLADE - A COMPARATIVE STUDY

Marlene Bruns

Leibniz Universität Hannover, Germany
m.bruns@isd.uni-hannover.de

Keywords: structural health monitoring,damage localization,model updating,optimization

Abstract: As one of the main renewable energy sources, wind energy has gained an important role in the generation of sustainable energy. For this reason, the aim to achieve a high degree of utilization as well as the aim to enhance the durability of wind turbines became vital research topics. Therefore, the ability to identify structural damage and consequently prevent component failure is a signifi-cant tool of interest in relation to flexible service intervals and condition-based maintenance of wind turbines. As rotor blades are related to about twenty percent of the overall costs of a wind turbine, monitoring their condition is of high interest for the reduction of operation and mainte-nance costs. Thus, the focus of this contribution is on the detection, localization and quantification of structural damage of wind turbine blades. There has been a development of many different non-destructive damage localization techniques over the past decades, whereby vibration-based damage localization techniques have successfully been used to monitor wind turbine blades. Vibration-based methods assume that damage-induced variations in the structural properties, namely mass, stiffness and damping, cause detectable changes in the structural behavior. In the presented work, a reference model of a parameterized offshore rotor blade is created. In order to predict damages in this reference model, the stiffness of certain cross sections is reduced. The simulation of the corresponding structural behavior creates a data set, representing the measured response of a damaged state. To detect, locate and quantify these changes, the structural properties of the reference model are adapted to the 'measured' response by comparing modal parameters. Then, cross sections with varied properties indicate the area where damage has occurred. To analyze the considered model updating procedure, different sets of sensor positions and different numbers of design variables are compared utilizing various optimization algorithms.