Defect distribution and reliability assessment of wind turbine blades

In this paper, two stochastic models for the distribution of defects in wind turbine blades are proposed. The first model assumes that the individual defects are completely randomly distributed in the blade. The second model assumes that the defects occur in clusters of different size, based on the assumption that one error in the production process tends to trigger several defects. For both models, additional information, such as number, type, and size of the defects, is included as stochastic variables. In a numerical example, the reliability is estimated for a generic wind turbine blade model both with and without defects in terms of delaminations. The reliability of the blade decreases when defects are included. However, the distribution of the defects influences how much the reliability is decreased. It is also shown how non-destructive inspection (NDI) after production can be used to update the reliability for the wind turbine blade using Bayesian statistics.