Kalman Filter Based Data Fusion for Bi-Axial Neutral Axis Tracking in Wind Turbine Towers
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Structural Health Monitoring (SHM) systems allow early detection of damage which allows maintenance planning and reduces the maintenance cost. So there is a lot of active research in the area for SHM of civil and mechanical structures. The SHM system uses a damage sensitive feature, and any change in the structure is reflected by a change in this feature. If this change is above a threshold the structure is said to be damaged. In most applications the determination of this threshold is based on engineering judgment and the previous experience of the operator. These practices are highly subjective to the skill of the operator and the uncertainty is more in case of unique structures or in unique conditions, like in the case of the newer high capacity wind turbines. So there is a need for a formal methodology for the selection of the thresholds for the chosen damage detection technique. This paper demonstrates a methodology for the selection of threshold for damage detection based on qualitative data acquired from several damage scenarios of a 10 MW wind turbine. The damage indicator is the change of neutral axis (NA) which is tracked using Kalman Filter (KF). Based on the level of damage to be detected and the probability of occurrence of false positive and false negative detections, a threshold value is selected. This threshold is then applied to strain data from the Nordtank NTK500/41 wind turbine for validation.

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