Calibration of dynamic models based on experimental measurements in a rotating environment

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Reliable stress and strain predictions in rotating systems, such as rotor- and wind-turbine blades, are essential to accurately estimate their remaining life and to schedule appropriate maintenance processes. Numerical inaccuracies are mostly due to structural degradation, unmodeled dynamics and errors in the representation of the applied loads. Accurate numerical predictions are obtained by combining a limited number of experimental measurements of the response into a numerical model, and by calibrating the model on these measurements. The proposed approach, called the confluence algorithm, updates either the external loads or the dynamic properties of the model to improve the accuracy of the full-field dynamic response by iteratively applying linearized corrections to a non-linear model based on experimental measurements. Numerical and experimental analyses show that the reconstruction of the response field is possible and accurate.