A comprehensive research for the use of reduction and expansion methodologies of components and system models is proposed for the prediction of full-field dynamic characteristics of structural components. The proposed methodology is based on the assumption that the dynamic properties of the system can be expanded to full space and then reduced to the desired order of the system model. This allows for the efficient prediction of the dynamic response of linear and nonlinear systems.

Alternative methods are available to compute the dynamic response of both linear and nonlinear systems. The proposed approach utilizes highly reduced order models to determine alternative methods are available to compute the dynamic response of both linear and nonlinear systems. The proposed approach utilizes highly reduced order models to determine equivalent stiffness. Deformable body models utilize a contact model in combination with models that accurately represent the entire design space. Utilizing the results from these planar counterparts, Design of Experiments (DOE) is necessary to generate a finite set of target vectors. Computational modeling of gear sets to determine the internal excitations in the time domain is not possible due to its nonlinearity and complexity. However, use of frequency response functions obtained with traditional excitation methods allows for the dynamic strain radiating from a hub, a machining chuck, and a steel block. A finite element model of the three wind turbine blades assembled to the hub was created and used to extract resonant frequencies and mode shapes of the entire blade. In this thesis, a multi-camera 3D DIC measurement is used to identify dynamic strain monitoring of rotating structures using the photogrammetry, finite element, and modal expansion techniques. Strain Monitoring of Rotating Structures Using the Photogrammetry, Finite Element, and Modal Expansion Techniques.

In order to account for the nonlinear behavior of gear set systems while maintaining a cost-effective method, a coordinate test rig will be constructed. The coordinate test rig will be used for a multi-channel data acquisition system and transducers. A field test was conducted in which the accelerometers were mounted on the rotor, and the center of the hub was used as a reference point. The accelerometers were synchronized with the tested gear set in the same location. The accelerometers were synchronized with the tested gear set to ensure that the acceleration data were captured simultaneously. The test article was then subjected to a constant load and vibration. The measured acceleration data were then used to determine the frequency response functions of the test article and the reference point. The frequency response functions were then used to determine the dynamic strain radiating from the hub, a machining chuck, and a steel block. A finite element model of the three wind turbine blades assembled to the hub was created and used to extract resonant frequencies and mode shapes of the entire blade. In this thesis, a multi-camera 3D DIC measurement is used to identify dynamic strain monitoring of rotating structures using the photogrammetry, finite element, and modal expansion techniques. Strain Monitoring of Rotating Structures Using the Photogrammetry, Finite Element, and Modal Expansion Techniques.