ABSTRACT

Project code:	BRG5980013
Project title:	Active control methods for multi-dimensional vibration of thin-walled rotor structures
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Project period:	15^{th} June 2016 - 14^{th} June 2019

To extend envelops of operation and performance, rotating machines are evolving away from solid-shaft design topologies towards more complex thin-walled rotor structures. Modern dynamic analysis methods can deal with rotating structures having complex three-dimensional geometric forms. However, there has been little published research on how realistic whole-rotor dynamic models can be exploited in the design of active vibration control systems. This project will address this deficiency by conducting basic research on the application of advanced active bearing technology with thin-walled rotor structures. The main focus of the work was vibration behavior and control methodologies. The main research outcomes were

1. New theoretical models of dynamic behavior of thin-walled rotors based on shell theory, with experimental validations.

2. New models of vibration excitation in thin-walled rotor structures due to asymmetry, including non-circularity effects, with experimental validations.

3. Development of a novel distributed actuation active magnetic bearings and associated sensing and control approaches for thin-walled rotors.

4. Development of active control approaches for whole rotor vibration subject to shaft bending and shell distortion.

The research findings are relevant to the design and operation of various machine types, particularly turbomachinery. They may also be used for new applications in the alternative energy field, such as wind and tidal power, where novel lightweight rotor/turbine structures may be realized using the active bearing technology developed through this project.

Keywords: structural vibration, rotating machines, rotordynamics, magnetic bearings, vibration control