NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

Cycle 18
January 2024

Principal Investigator: Joseph Turner
Position Title: Robert W Brightfelt Professor of MME
Department: Mechanical and Materials Engineering

Email: jaturner@unl.edu
Phone: 402-472-8856
Webpage: https://ncmn.unl.edu/faculty/turner

Project Title.
Next Generation Embedded Wireless Sensors for Structural Health Monitoring of Wind Turbines

Abstract.
The purpose of this project is to design, manufacture, and test a bearing roller that serves an additional role as an embedded wireless sensor within a wind turbine gearbox. We will create this 'smart roller' using advanced metal additive manufacturing (AM) technology (i.e., metal 3D printing) with a specific material organization to support internal sensor(s). Current structural health monitoring (SHM) of wind turbines relies on sensors that collect information outside the main turbine gearbox such that advanced modeling is required to interpret the data. The proposed new embedded sensor concept would transform SHM of wind turbines by provided immediate and direct measurement data internal to the most critical part of the power generation system. Our team has successfully created solid AM bearing rollers that performed well during rolling contact fatigue tests. We also have a solid background in wireless sensor development.

The funding provided by this Energy Research Grant would support modeling, manufacturing, characterization, sensor development, sensor integration, and overall performance evaluation.

This work will position our team well to cultivate collaborations with the National Renewable Energy Laboratory, to obtain major funding from major federal funding sources, and to pursue appropriate technology transfer. Our primary target will be the Department of Energy for wind turbine structural health monitoring applications. However, this research also has potential at other agencies within the Department of Defense, the Federal Railroad Administration, and from the National Science Foundation.