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A rotational energy harvester for propulsion systems: design and experimental validation

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Abstract: Modern control systems in propulsion applications can ensure the smooth and efficient operation and assist in detecting failures at early stages. The implementation of these control systems is restricted by the availability of sensor data, such as the stress experienced by a rotating shaft. Wireless sensor technology could be mounted to rotating components but nevertheless powering these sensors is a technical challenge. Traditionally batteries or slip rings would be used but these have a relatively short service life, which could lead to unacceptable maintenance demands. Energy harvesters may solve this issue by utilising vibration energy and converting it to useable electrical energy. In the present work, the prototype of a duffing-type rotational electromagnetic energy harvester is designed and tested, based on a previously published model of the authors. The harvester takes energy from the torsional speed fluctuations of a rotating shaft, commonly found in propulsion systems. The experimental results show a broadband response of the energy harvester to achieve useful power generation across a wide range of shaft speeds, which agrees well with the numerical model predictions.

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