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Thermal Energy Harvesting with Wireless Sensor Node for Gearbox Condition Monitoring

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ABSTRACT

With the rotating speed and load of different stages of industrial machine during operation processes causes temperatures in the components in the machines. This paper a comparison study of different measurement, based on a gearbox test rig, between the wireless sensor node and wired measurement for condition monitoring. A thermoelectric generator module (TEG) is optimized to harvest the electrical power from a heat source such as the gearbox undergoing such monitoring. The power generation from this method is obtained based on temperature gradients emanated by sandwiching the TEG between the two aluminum plates. One plate is exposed to the heat source and has the role of a heat collector, whereas the other plate, mounted with a low profile heat-sink, acts as a heat spreader. The harvested power is then used to power a wireless temperature node for condition monitoring, resulting in a powerless and wireless monitoring system. To evaluate the system, a gearbox is monitored by the designed vibration node. The measuring node is based on using a TEG module, ultra-power which using an LTC3108 DC-DC converter for boosting the voltage, super-capacitor and a sensor tag CC2650 for measuring the vibration of the gearbox. Data can be transferred via Bluetooth Low Energy and received by CC2540 then monitored using portable monitoring devices, such as PC. The results obtained show the system can provide monitoring of the vibration information.

Keywords: Energy harvesting; wireless sensor networks; condition monitoring; thermoelectric generator, CC2650, BLE.