**ABSTRACT**

Transmission error (TE) is well acknowledged as the main source of gear vibration. It describes the meshing error between two gears. In the literature, the term TE can be understood from two different perspectives. The first, which is also more commonly used, is the actual physical TE that exists in a gear pair. This TE is primarily caused by geometric errors on the tooth profile and stiffness-induced deflections of the gear teeth. Consequently, faults such as wear and cracks would modify the gear tooth profile and stiffness respectively, thus leading to a change in TE. Another perspective of TE is the TE signal measured using encoders installed on a gearbox, which is becoming more popular. Studies have shown that TE measurements are useful in the quantification of fault severities, for both wear and cracks. This is possible given that measured TE is one of the closest measurements to the source of internal excitation from the gearmesh.

Compared to TE, the application of vibration measurements in gear condition monitoring is more established. However, vibration is affected by a complex transfer function, due to the complicated transmission path from the gear mesh to the sensor location, which is usually on the gearbox casing. It is unclear how vibration or its signal components are related to the source.

This paper therefore attempts to study the relationship between vibration and its source, by extracting the crack-symptomatic components of vibration signals, and comparing them with measured TE. This is achieved using vibration and TE measurements from gear crack tests, involving different crack sizes. It is seen that TE provides clearer diagnostic information for cracks compared with vibration signals.

**Keywords:** gear cracks, gear diagnostics, transmission error, vibration.