EMPIRICAL COMPENSATION OF PARASITIC BEARING FRICTION IN CHAIN DRIVE DYNAMOMETERS

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Friction, experiments in tribology, modelling in tribology, parasitic compensation.

ABSTRACT
Performance of chain drives is of current interest in mechanical systems and bicycles to maximise the useable power delivered to a driven shaft or axle. Such transmissions incur relatively small losses for large transmitted powers, which presents challenges for high accuracy measurement of these losses. This is especially true where high-fidelity emulation of real-world conditions is necessary. A solution for practical measurement of the performance of a chain drive system in such conditions is a Transmitted Power Measurement (TPM) chain drive dynamometer [1] (Fig. 1).

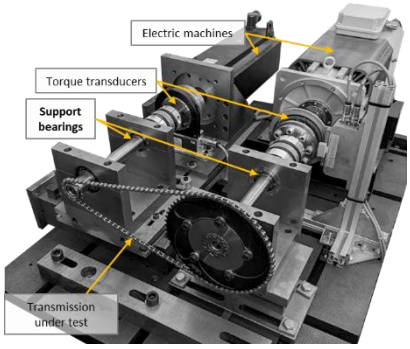

Fig.1 Chain drive dynamometer with support bearings to isolate radial load from measurement equipment.

In TPM dynamometers support bearings are required to protect the measurement devices from bending moments induced by span tension in the test subject. These support bearings are hence situated within the measurement loop of the dynamometer, such that their frictional influence is included in the total measured losses. To accurately describe the chain losses, the parasitic influence of the bearings must be compensated.

Experimental methods demonstrated in the literature may not be appropriate for high torque applications as the radial load dependency of losses is not described [2]. Another method is to predict the frictional moment using models of bearing frictional moment [3] [4].

This study presents a novel method of empirical compensation of the frictional moment in support bearings using a secondary experimental test rig (Fig 2). Measured frictional torque in bearings on this experimental rig is applied to data from a TPM dynamometer to compensate for bearing friction.

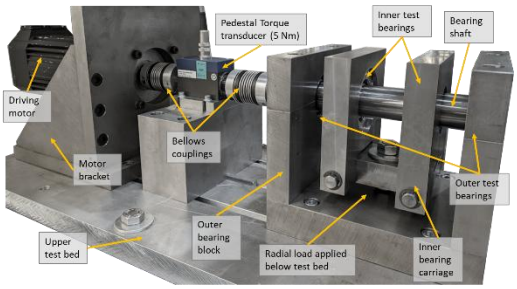

Fig.2 Radial load bearing test rig.

The combination of radial load and rotational speed are unique to each of the four support bearings on the chain drive dynamometer. Frictional moment of each individual bearing is determined from empirical data on the bearing test rig and individually compensated on the chain dynamometer.

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