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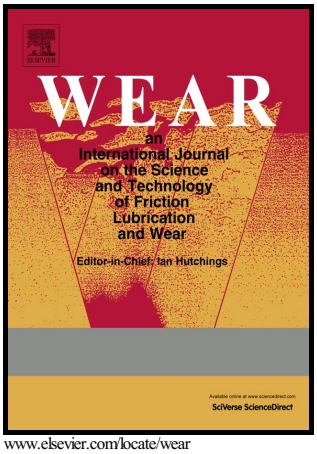

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A Prototype of On-line Extraction and Three-dimensional Characterisation of Wear Particle Features from Video Sequence

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Abstract

Wear particles in lubricants carry valuable information about machine wear status which is useful in machine condition monitoring. For wear analysis, wear particles are often imaged and their features are extracted. However, the particle morphology acquired from current 2-dimensional (2-D) images does not contain thickness information which can be critical in wear mechanism interpretation. In this paper, we present the development of a video based system to extend the particle information in 3-dimension (3-D). The proposed method contains three main procedures including: particle extraction using a Gaussian mixture model, multiple particle tracking with Kalman filter, and 3-D feature reconstruction by the shape-from-silhouette method. This framework ensures that wear particles are correctly extracted, and their 3-D morphological features are obtained. It also can be regarded as a potential option for on-line particle monitoring. The performance of this method was demonstrated by analysing wear particles generated from a four-ball machine and a spur gear box, and verified by computer simulations. Results indicated that 3-D features of wear particles were obtained with satisfactory accuracy.

Keywords: Particle shape, Ferrography, Optical microscopy, Wear testing

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