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Characterization and Monitoring of the Yarn Faults Using Diametric Fault System

Authors : S. M. Ishtiaque, V. K. Yadav, S. D. Joshi, J. K. Chatterjee

Abstract : The DIAMETRIC FAULTS system has been developed that captures a bi-directional image of yarn continuously in sequentially manner and provides the detailed classification of faults. A novel mathematical framework developed on the acquired bi-directional images forms the basis of fault classification in four broad categories, namely, Thick1, Thick2, Thin and Normal Yarn. A discretised version of Radon transformation has been used to convert the bi-directional images into one-dimensional signals. Images were divided into training and test sample sets. Karhunen–Loève Transformation (KLT) basis is computed for the signals from the images in training set for each fault class taking top six highest energy eigen vectors. The fault class of the test image is identified by taking the Euclidean distance of its signal from its projection on the KLT basis for each sample realization and fault class in the training set. Euclidean distance applied using various techniques is used for classifying an unknown fault class. An accuracy of about 90% is achieved in detecting the correct fault class using the various techniques. The four broad fault classes were further sub classified in four sub groups based on the user set boundary limits for fault length and fault volume. The fault cross-sectional area and the fault length defines the total volume of fault. A distinct distribution of faults is found in terms of their volume and physical dimensions which can be used for monitoring the yarn faults. It has been shown from the configurational based characterization and classification that the spun yarn faults arising out of mass variation, exhibit distinct characteristics in terms of their contours, sizes and shapes apart from their frequency of occurrences.

Keywords : Euclidean distance, fault classification, KLT, Radon Transform
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