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Automatic Registration of Rail Profile Based Local Maximum Curvature Entropy

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Abstract : On the influence of train vibration and environmental noise on the measurement of track wear, we proposed a method for automatic extraction of circular arc on the inner or outer side of the rail waist and achieved the high-precision registration of rail profile. Firstly, a polynomial fitting method based on truncated residual histogram was proposed to find the optimal fitting curve of the profile and reduce the influence of noise on profile curve fitting. Then, based on the curvature distribution characteristics of the fitting curve, the interval search algorithm based on dynamic window's maximum curvature entropy was proposed to realize the automatic segmentation of small circular arc. At last, we fit two circle centers as matching reference points based on small circular arcs on both sides and realized the alignment from the measured profile to the standard designed profile. The static experimental results show that the mean and standard deviation of the method are controlled within 0.01mm with small measurement errors and high repeatability. The dynamic test also verified the repeatability of the method in the train-running environment, and the dynamic measurement deviation of rail wear is within 0.2mm with high repeatability.

Keywords : curvature entropy, profile registration, rail wear, structured light, train-running
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