On the defect tolerance based fatigue crack growth life prediction of railway axles

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Abstract

The railway axles are one of the most important components of a rail vehicle. However, railway axles obviously have defects in the manufacture, transportation, processing, service and maintenance. Under the effect of fatigue loading, it causes crack initiation and propagation, and even the fracture of axles. In this paper, the geometry model of surface crack of a railway axle with flaws is built, and the stress intensity factor at the crack center point is calculated using the analytic formula under the rotary bending load. Meanwhile, The NASGRO equation is used to build the propagation model of fatigue crack and the propagation condition of the crack is analyzed. Finally, fatigue crack propagation rate and residual remaining life have been calculated as the basis of the nondestructive inspection cycle project.

Keywords: Fatigue crack propagation; Railway axles defects; Stress intensity factor; Damage tolerance.