Are multiaxial fatigue criteria appropriate when steels with surface defects are subjected to rolling contact fatigue?

H. J. Desimone¹, A. Bernasconi², S. Beretta²

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ABSTRACT

The fatigue strength assessment of parts subjected to rolling and sliding contacts is a multiaxial fatigue problem because of the cyclic variation of the six components of the stress tensor, which generate non proportional stress paths. In real steels, the difficulty of the problem is increased by the presence of defects, which has to be considered in order to achieve an accurate assessment of their multiaxial fatigue strength.

In this context, this paper analyzes the behavior and accuracy of some multiaxial fatigue criteria when dealing with a quenched and tempered steel with and without defects. Several fatigue tests on smooth and micronotched specimens were carried out, for different stress ratio conditions. The results are confronted with the most popular multiaxial fatigue criteria of the critical plane class (e.g., Dang Van, Findley) and implementing an integral approach (e.g., Liu-Zenner).

Even if some of these criteria fit the results when smooth specimens are considered, noticeable contradictions arise when they are applied to steels containing defects. From this point of view, it seems that new criteria should be considered for rolling contact fatigue in presence of defects.

¹ Tenaris
² Politecnico di Milano
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