Multiaxial Fatigue Life Modelling Using Hybrid Approach of Critical Plane and Genetic Algorithm

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ABSTRACT
This paper presents a new hybrid approach for multiaxial fatigue life estimation, based on continuum damage mechanics theory and a genetic algorithm with critical plane model formulation. The hybrid model employs a genetic algorithm based setup for calibration with standard proportional and non-proportional profiles to predict fatigue life for complex loading profiles. The model is evaluated using experimental fatigue life data for SS304 steel. Calibration using simplified profiles is in agreement with the requirement for cost-effective experimental fatigue life testing. In-phase and out-of-phase loads are used for calibration, and fatigue life is predicted for more complicated profiles. The results show good agreement between the estimated and experimental fatigue life, and calibration through simple loading histories to predict fatigue life for complex histories appears to be an effective solution using the proposed model. A brief comparison is presented with fatigue life estimation performance of the proposed model with models available in commercial codes. Proposed model found to be more consistent in fatigue life prediction against various loading conditions.

KEYWORDS: continuum damage mechanics theory; critical plane method; genetic algorithm; multiaxial fatigue

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