Discretized Markov Chain in Damage Assessment Using Rainflow Cycle with Effects of Mean Stress On An Automobile Crankshaft

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ABSTRACT
We studied the effect of mean stress correction factor using the *Rainflow* counting technique to assess the fatigue damage of an automobile crankshaft under service loading by considering the stochastic process of the Markov chain. The failure of the crankshaft will cause serious damage to the engine and also to other connecting subcomponents. The service loading is computationally generated from the Discrete Markov chain model and the fatigue cycle is counted using the Rainflow counting technique with the consideration of the local minima and maxima load. To quantify the fatigue damage, the strain-life curve using the fatigue mean stresses was used to model the fatigue failure of the material used in for the crankshaft at $N_f = 10^6$. The fatigue mean stresses were used to estimate the effects of the mean stress on the fatigue strength of the component under service loading condition. Statistical verification with the boundary condition of the 90% confidence level was performed to observe the difference between the stochastic algorithms when compared towards the fatigue life behavior of the ductile cast iron material. We concluded that for the practical application, the proposed stochastic model provides a highly accurate assessment of fatigue damage prediction for improving the safety and controlling the risk factors in terms of structural health monitoring.

KEYWORDS: Crankshaft; Fatigue assessment; Markov chain; Mean stress correction factor; Rainflow

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