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FATIGUE ANALYSIS ON CRANK SHAFT

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Abstract

The objective of this study was to compare the durability of crankshafts from two competing manufacturing processes, as well as to perform dynamic load and stress analysis, and optimization. The crankshafts used in the study were forged steel and ductile cast iron from a one-cylinder gasoline engine. Strain-controlled monotonic and fatigue tests as well as- impact tests were performed on specimens machined from the crankshafts. Load-controlled component bending fatigue tests were also carried out on the crankshafts. Material tests showed that the forged steel had 26% higher tensile strength and 37% higher fatigue strength than the ductile cast iron, while component tests showed that the forged steel crankshaft had 32% higher fatigue strength resulting in a factor of six longer fatigue life. The S-N approach used to predict the fatigue lives of both crankshafts showed reasonable correlation to the experimental data from the component tests. Dynamic load analysis was performed to determine the in service loading of the crankshafts and FEA was conducted to find stresses at critical locations. Finally, the geometry, material, and manufacturing processes were optimized for the forged steel crankshaft. The optimization process included geometry changes compatible with the current engine, fillet rolling, and the use of MA steel, resulting in 18% weight reduction, increased fatigue strength and reduced cost of the crankshaft.

Keywords : Stress concentrators, fatigue crack propagation, fatigue life prediction_methods, Analysis in Ansys.