

Thermoelastic analysis of a bearing-cage seam weld

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Abstract

This manuscript discusses the implementation of a thermo-elastic setup and analyses, to monitor and record the stress levels at the weld-seam of a bearing-cage, under different loadings. The setup includes a high speed, ultra sensitive infrared focal plane array and an in-house developed pre and post-processing codes. The pre-processing neutralizes the emittance variation with the cage geometry using new mapping scheme, while the post-processor creates spatial neighbourhoods to average the stress signal and reduce the detector and the environment noise; also the algorithm checks for the adiabatic conditions through the synchrony between the load cyclic frequency and that of the temperature differentials. The thermo-elastic investigation is done at different loadings from 20 – 140 Lbf at a frequency of 10 Hz, in two modes: a calibration mode with the weld-seam located at 9 clock position and a detailed mode with the weld-seam at 6 clock location. A Finite Element FE simulation is used to adjust the thermo-elastic constant using the calibration trials (weld at 9 clock). The detailed trials (weld at 6 clock) are then compared with the FE simulation, showing good agreement in predicting the stress values and maps. The proposed hardware and software map the stresses 3 dimensionally for the weld region with a 25 MPa resolution, in real-time and is found to resolve stress changes for each 20 Lbf loading.

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