Vibration fatigue analysis of a strut for airborne radar

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Struts for airborne radar are subjected to a random form of loading such as wing flutter, vortex shedding or engine vibrations, vibration of the aircraft and the radar, and so on. Vibration measurements have been performed on the struts to characterization the "strut noise" fatigue problem which has introduced a detailed characterization of noise, vibration and fatigue life. Transverse forces on the struts due to the random vibration should be considered when estimate the fatigue life of the struts.

To estimate the transverse forces at end of the strut due to the strut vibrations, an inverse analysis is performed. First, a frequency response analysis is performed on a finite element model to compute the transfer function. Then the PSD response at the measured location that caused by PSD input loading is obtained by multiplying the transfer function by the input loading PSD.

Two kinds of external loads have been assumed here. One is a uniform distributed external load that applied across the aluminium profile as excitation source, while the other one is a base excitation, e.g. acceleration at the end of the strut. The PSD load that can generate the same acceleration response at the measured location is used to calculate the PSD of the shear force.

The fatigue life of the strut can then be estimated using frequency based fatigue techniques.