Durability Analysis of 3-Axis Input to Elastomeric Front Lower Control Arm Vertical Ride Bushing

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ABSTRACT. Fatigue life prediction of elastomer NVH suspension products has become an operating norm for OEMs and suppliers during the product quoting process and subsequent technical reviews. This paper reviews a critical plane analysis based fatigue simulation methodology for a front lower control arm. Filled natural rubber behaviors were measured and defined for the analysis, including: stress-strain, fatigue crack growth, strain crystallization, fatigue threshold and initial crack precursor size. A series of four distinct single and dual axis bench durability tests were derived from OEM block cycle specifications, and run to end-of-life as determined via a stiffness loss criterion. The tested parts were then sectioned in order to compare developed failure modes with predicted locations of crack initiation. In all cases, failure mode was accurately predicted by the simulation, and predicted fatigue life preceded actual end-of-life by not more than a factor of 1.4 in life.

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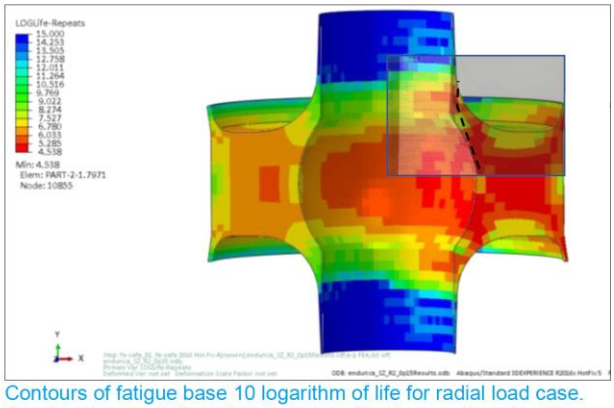
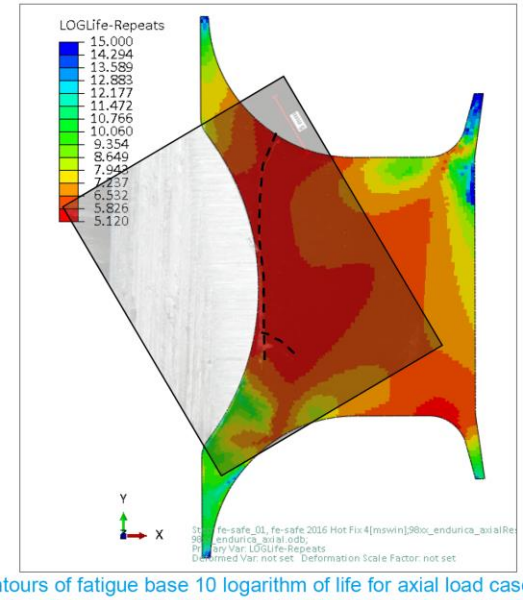


Contours of fatigue base 10 logarithm of life for radial load case.
Overlay shows section of tested part with observed crack path.

Predicted Life = 17257

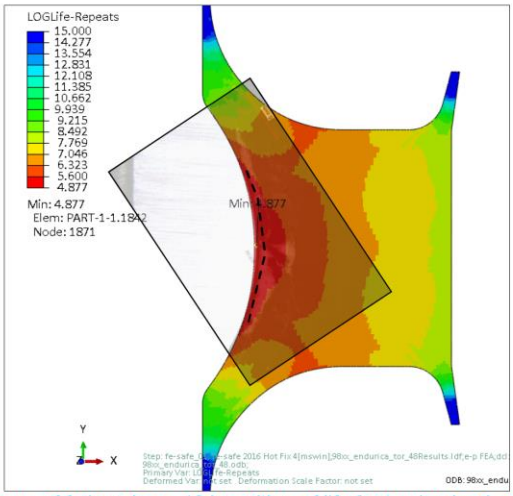
Average Actual Life = 19605



Contours of fatigue base 10 logarithm of life for axial load case.
Overlay shows section of tested part with observed crack path.

Predicted Life = 65912

Average Actual Life = 77682



Contours of fatigue base 10 logarithm of life for torsion load case.
Overlay shows section of tested part with observed crack path.

Predicted Life = 51314

Average Actual Life = 71840

This is a synopsis. See citation source for full paper.