

## Design and fatigue testing under VHCF conditions

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### Abstract:

Fatigue damage has special relevance on the life span of mechanical components and structures, as it takes responsibility for the majority of the registered structural failures. Although its mechanisms have been the subject of continuous research, the growing need for greater lifespans forced the understanding of the behavior of materials under very high cycle loadings, also known as Very High Cycle Fatigue.

On the other hand the behavior of materials under multiaxial fatigue has been the subject of research and development, but not in the region of very high cycles, due to the inexistence of appropriate machinery to perform these tests. The authors of this work have already a large experience on the performance of multiaxial fatigue tests under axial/torsion loading under servo-hydraulic fatigue testing machines and on very high cycle fatigue tests.

In this work, a device designed to produce biaxial, axial/torsional loading fatigue testing using a single piezoelectric axial exciter is presented, as well as the instrumentation used on the preliminary testing of this device. The device is comprised of a horn and a specimen, which are both attached to the piezoelectric exciter. The steps taken towards the final geometry of the device, including special designed horn and specimen are presented.

Experimental testing of the developed device is carried out using thermographic imaging, strain measurements and vibration speeds, and indicates good behavior of the different tested specimens, from different type of materials.

### Key words:

Fatigue testing, design, VHCF