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Predicting the Axial Load Capacity of joints formed by V-Band Retainers

**Introduction**

V-band retainers are widely used in the automotive, aircraft and aerospace industries to connect a pair of circular flanges to provide a joint with good axial strength and torsional rigidity. V-band retainers are manufactured using a cold rolling process. Despite their wide application, once assembled to a pair of flanges little is known about the interaction between flange and band. Moreover the failure mode of V-band clamps when applying an axial load is not fully understood.

**Objectives**

- Generate Finite Element (FE) modelling techniques to predict work hardening development during manufacture cold rolling process
- Understand the relationship between V-band tightening force, internal stresses and joint axial load capacity by conducting experimental tests
- Produce FE models, validated by experimental data to predict V-band joint axial load capacity and study internal stresses
- Extend existing theory of V-band behaviour including plastic deformation

**Aim**

To provide a robust method of predicting the axial load capacity of joints formed by V-Band retainers

**2D Finite Element Analysis**

- 2 dimensional FE- analysis of first stage of cold rolling process including all six passes forming the sections
- Numerical plastic strain values showed very good correlation with measured work hardening values


**Predicting Axial Load Capacity**

- Axisymmetric 2 dimensional FE-analysis of V-band retainer assembled to flanges
- Increasing V-band diameter leads to more and more elastic deformation
- Analysis is not capable of predicting influence of T-bolt, but results correlate well with experiments

For more information see: Ultimate Axial Load Capacity of V-Section Band Clamps, submitted to Institute of Physics, 7th International Conference on Modern Practice in Stress and Vibration Analysis’ 2009

**3D Finite Element Analysis**

- 3 dimensional FE-analysis of cold rolling process including both stages and seven passes forming a complete circular V-band retainer
- Unlike 2D model, this analysis is able to predict influence of band length, distance between roller pairs, forming length, springback, buckling and longitudinal strain development on the resulting product

**Further Work**

- Generate a methodology to determine contact pressure between V-band retainer and circular flanges measuring roughness of inner side of V-band
- Generate an analysis in which the retainer from the 3D FE-analysis is assembled to a pair of circular flanges and an axial load is applied, so the ultimate axial load capacity can be predicted taking into account the plastic strain induced by rolling process

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