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

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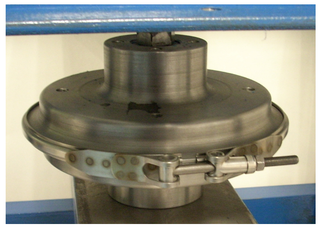
Introduction



V-band retainer assembled to circular pair of flanges

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

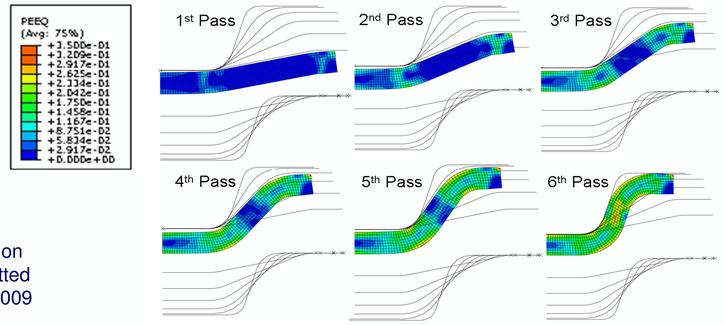
•Generate Finite Element (FE) modelling techniques to predict work hardening development during manufacture cold rolling process
•Understand the relationship between V-band tightening force, internal stresses and joint axial load capacity by conducting experimental tests
•Produce FE models, validated 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

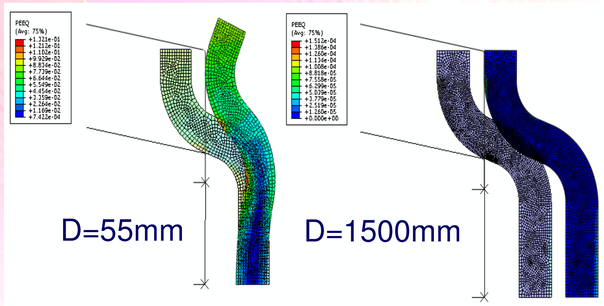
•2 dimensional FE- analysis of first stage of cold rolling process including all six passes forming the sections
•Numerical plastic strain values showed very good correlation with measured work hardening values



For more information see: Predicting Plastic Deformation and Work Hardening during V-Band Formation, submitted to Journal of Strain Analysis for Engineering Design, 2009

Predicting Axial Load Capacity

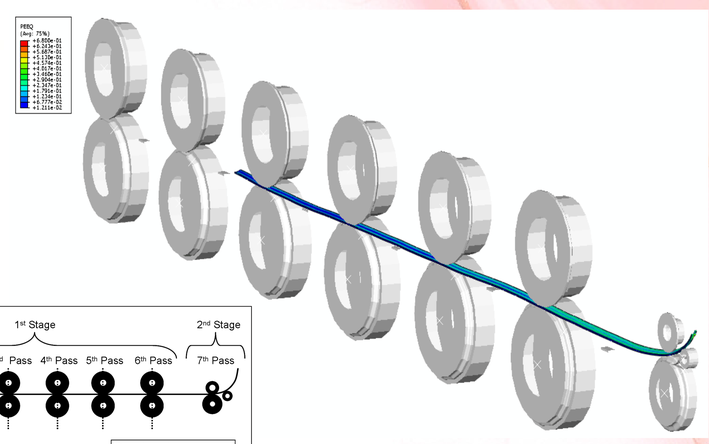
•Axisymmetric 2 dimensional FE-analysis of V-band retainer assembled to flanges
•Increasing V-band diameter leads to more and more elastic deformation
•Analysis is not capable of predicting influence of T-bolt, but results correlate well with experiments



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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