NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Rolls-Royce@NTU Corporate Lab

Supported by:
NATIONAL RESEARCH FOUNDATION
PRIME MINISTER'S OFFICE
SINGAPORE

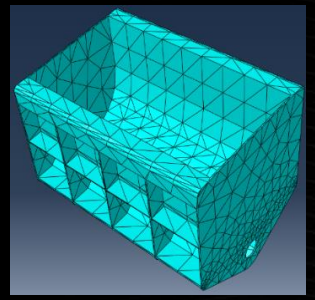
A Hybrid Approach to Surface & Sub-Surface Treatment

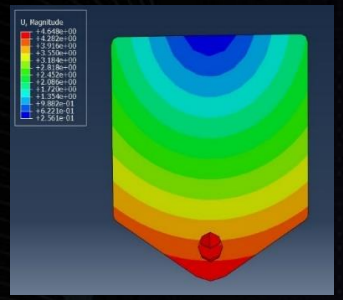
Development of novel surface finishing process – Vibropeening

The findings of the project will support vibropeening process maturation and development in collaboration with ARTC. Additionally, a numerical predictive model will be developed to study the associated key process variables that satisfies RR Aerospace surface property requirements. Enhancement in overall fatigue life of the component and reduction in the process time will increase turbine reliability and also reduce production cost.

Stage 1: Geometric model creation

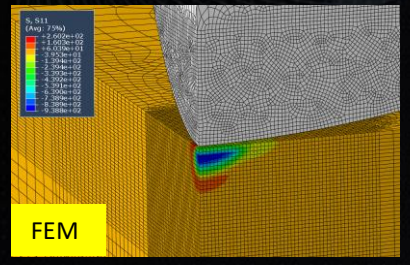
CAD drawing for vibratory machine and kinematic analysis for trough movement





Stage 2: Numerical modeling approach

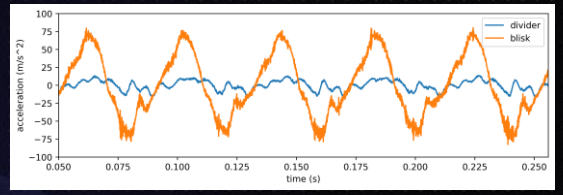
Media consisting of rigid metallic particles modelled using coupled discrete element (DEM) and finite element (FEM) to understand their contact forces and motion



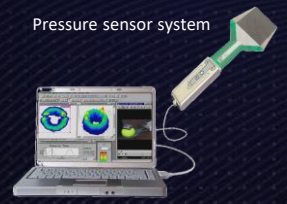
Stage 3: Experimental approach

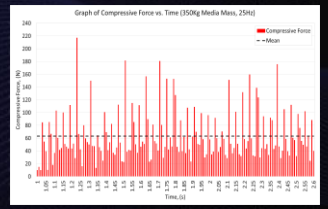
Incorporation of a variety of sensors to extract the process output for numerical validation


Tri-axial accelerometer



Pressure sensor system





Achievement

Initial numerical DEM and FEM simulations validated with experiments on aerospace grade material coupons – showing

1. promising simulated versus measured contact force correlation and
2. predictive capability of the numerical model.