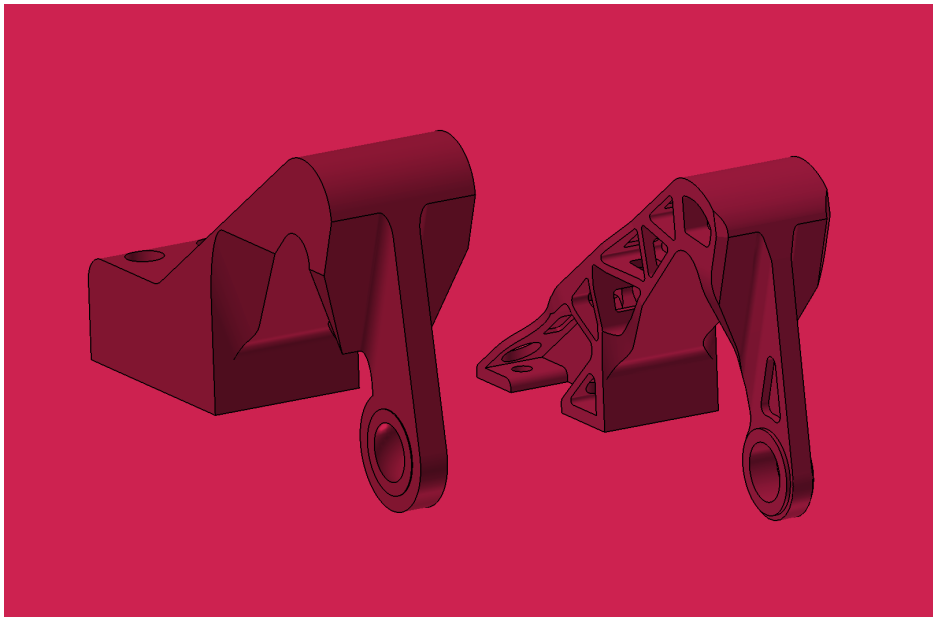
EVOTECH
Computer-Aided Engineering Ltd

Case Study



Project Scope:
Structural Optimisation and Finite Element Analysis to support weight reduction of an aerospace component for Additive Manufacture

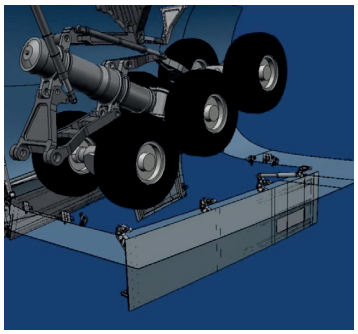
Toolsets: MSC Apex Modeler and Structures (Eagle Release), MSC Nastran

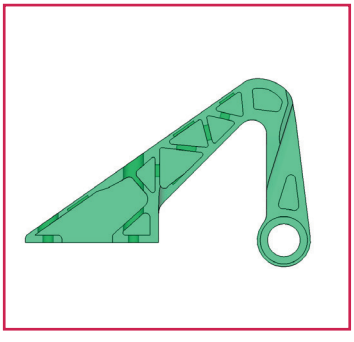
Outcome: 63% Mass Reduction whilst achieving a minimum Margin of Safety of 1.005

Alcoa Fastening Systems and Rings

Evotech Computer-Aided Engineering Ltd is an Engineering Consultancy based in the UK, specialising in product development through advanced Finite Element Analysis (FEA). With a background predominately in the Aerospace industry, we are expert in multi-scale model development, analysis and structural optimisation, and hold NAFEMS PSE Certification at Advanced level (including Non-Linear Analysis, Composites, Optimisation and FE Model Verification).

In addition, Evotech CAE Ltd work with MSC Software as 'Elite Partners' for the CAE toolset, Apex, which offers a radical new paradigm in Finite Element Model Management, Build and Analysis. This case study highlights the product development work that has been used to develop an A380 Landing Gear Door Bracket for Alcoa Fastening Systems and Rings, via a GrabCAD Challenge.



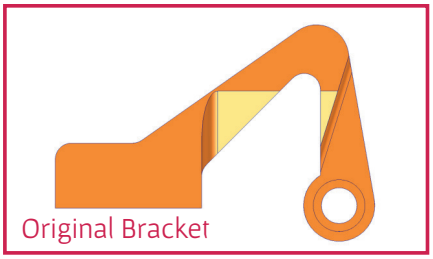


GRABCAD

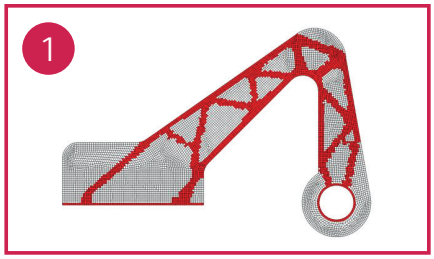
MSC Apex

Design Objectives

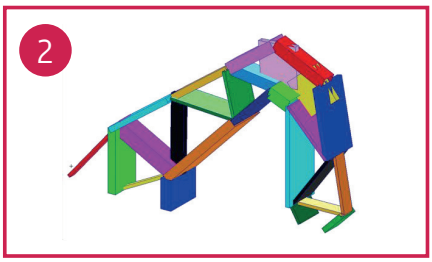
- To mass optimise the Airbus A380 Landing Gear Door Bracket design to encompass Additive Manufacturing technology, whilst achieving 'Margin of Safety>1.0' for three discrete design cases.
- Not to exceed existing bracket volume and maintain fastener lay-out.
- To respect minimum geometric feature dimension of 0.025", and minimum wall thickness of 0.045".
- Resultant bracket to be 3D printed using 15-5PH Steel, 145 KSI tensile yield stress.



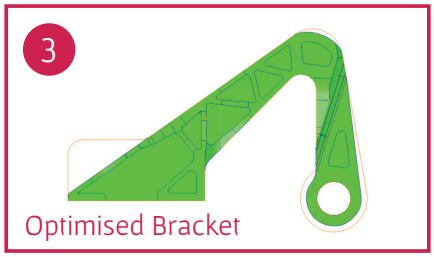
Step 1 – Topology Optimisation

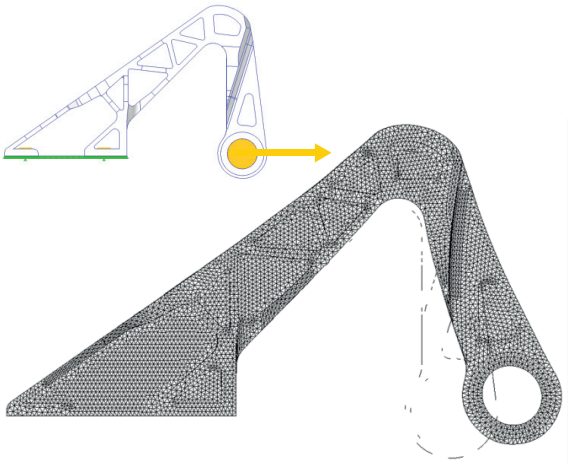


Step 2 – Sizing Optimisation



Step 3 – Direct Modelling Optimisation



Design Outcomes

- Optimised bracket design, which demonstrates a 63% mass reduction, from 1.892lbs (860g) to 0.705lbs (320g), with a minimum MoS of 1.005.
- Robust Finite Element Analysis to demonstrate converged stress distributions.
- Physical bracket models generated to demonstrate 3D printing concept, whilst not including internal voids, and hence allowing for 'in-service' crack detection.