Oldham Joint

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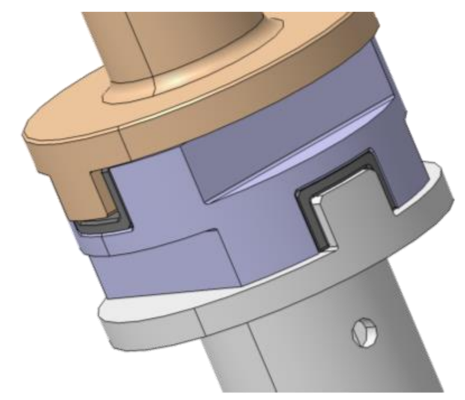
INTRODUCTION

- Joint needed for use in airplane door attach misaligned shafts
- Desired to ease assembly of door
- High torque and low speed setting (airplane door handle)
- Long lifetime with zero lubrication/maintenance

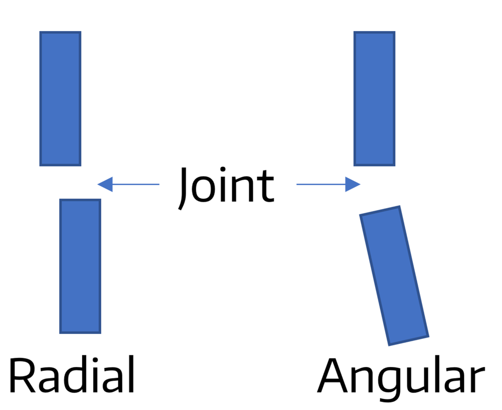


Originally proposed solution: Oldham coupling with flexible intermediate material

PROBLEM STATEMENT

Design a joint that can transmit a high torque at a low speed between two shafts that are both radially and angularly misaligned while conforming to the design requirements specified by Latécoère.

CORE FUNCTIONS



Types of possible misalignment in the shafts

- 3mm radial
- 1 degree angular
- Torque:
  - Operating: 50 Nm
  - Limit: 467 Nm
  - Ultimate: 700 Nm
- 20 years, 120,000 cycles
  - Zero maintenance
- <15% friction increase

FEATURES

- Semicircular rotation allows for larger angular displacement, with radial movement
- High contact area
- No galling
- Minimal wear

First 3D printed prototype of type UA coupling

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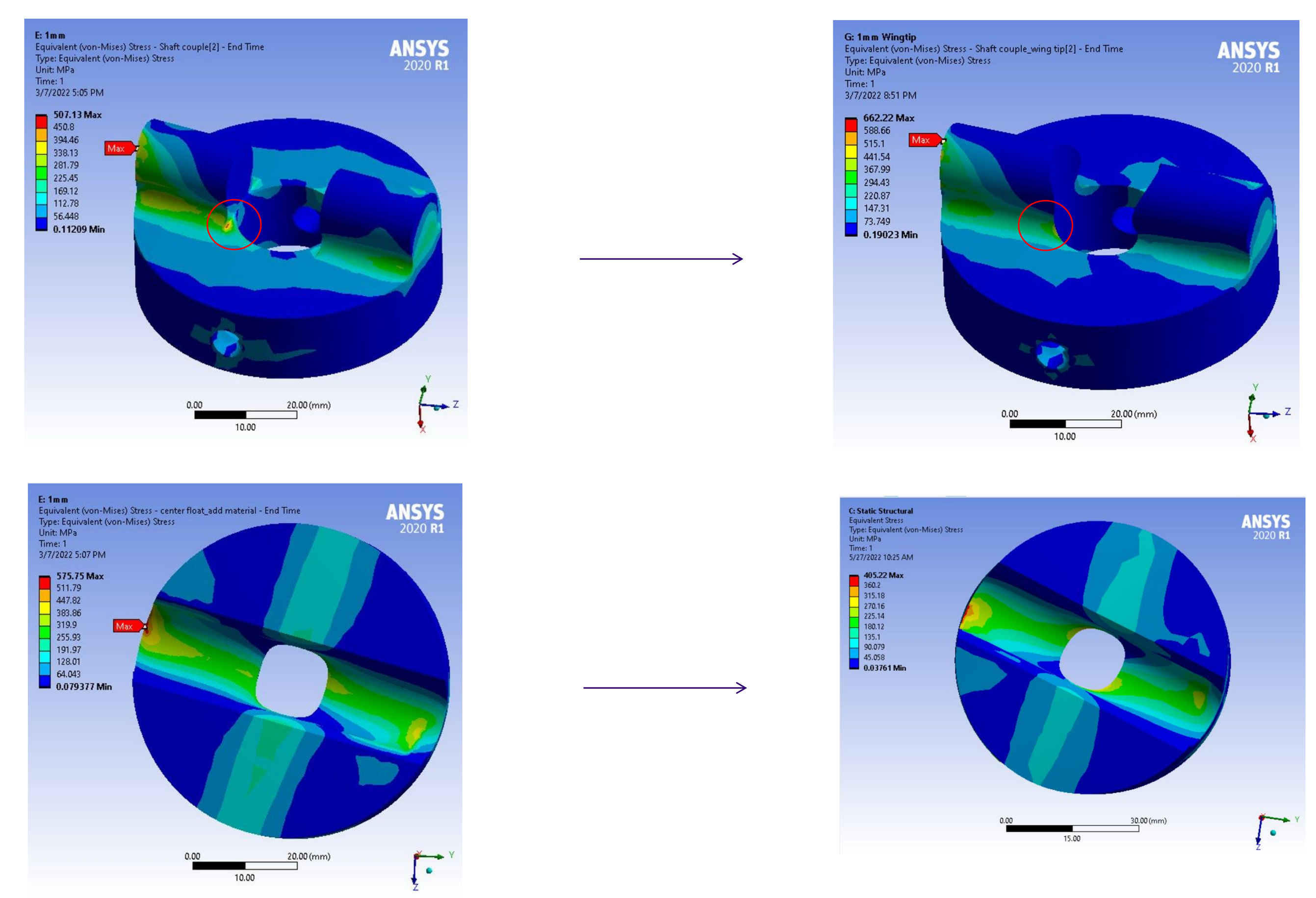
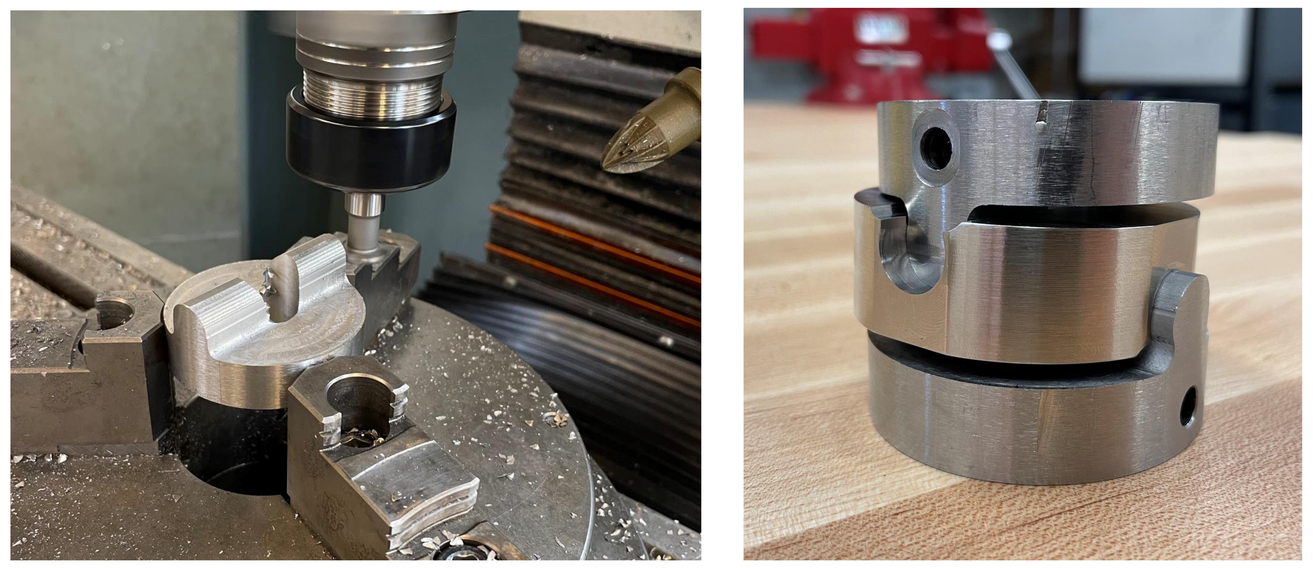
DESIGN AND DEVELOPMENT



FEA analysis of components to remove stress concentrations and lower overall stress

Prototype/Analysis

- Two Parts designed: shaft couple, center float
- optimized using FEA to stay within acceptable stress levels under a 467 Nm load

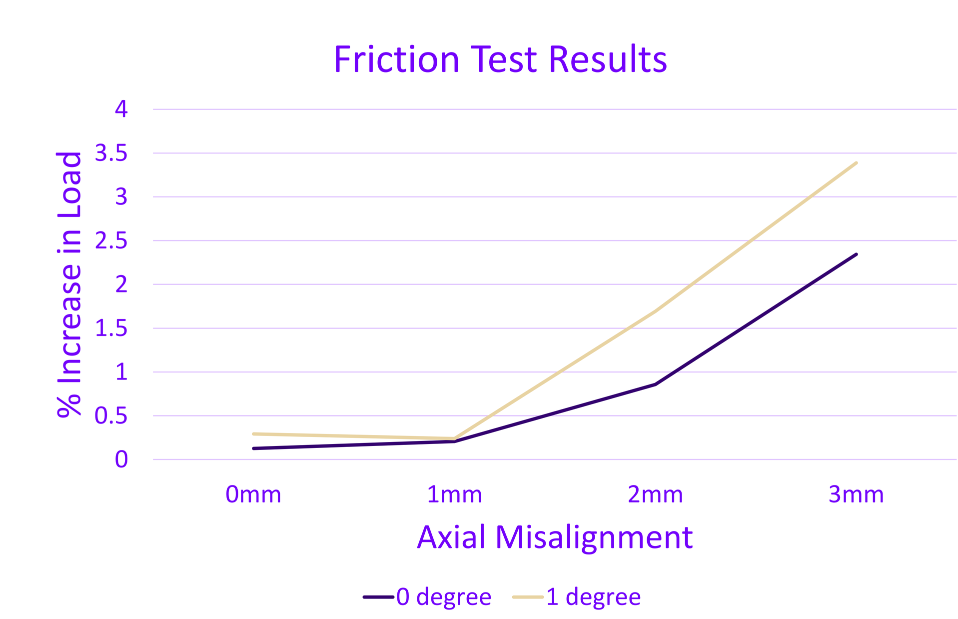


Left: Shaft couple during machining on a 3-axis CNC mill;
Right: Completed joint after machining

Manufacturing Process

- All parts were manufactured in the ME machine shop
- Shaft couple was made using contouring on a 3-axis CNC mill taking multiple attempts and many hours
- Center float also made on a mill with 2 intersecting reamed holes

RESULTS/VALIDATION



Friction Test Setup

- Requirement: <15% increase in load at 50Nm torque with up to 3mm axial and 1° angular misalignment
- 50Nm torque applied to joint and resulting friction measured
- Results: Max increase in load was 3.39% at 3mm axial and 1° angular misalignment

CONCLUSION & FUTURE WORK

- Excels in strength and galling resistance
- Weak in strength to weight ratio (heavy)
- Look into:
  - Wear testing to ensure lifetime on component
  - Additively manufactured materials
  - Internal material reduction to lower weight
  - Lighter, easily machinable materials
    - Low density and high strength alloys

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