

Use of Friction Stir Welding on primary structures of aircrafts instead of riveted junction

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Topics :

- Theoretical and numerical approach - Damage evaluation and Fatigue design
- Industrial case study - Transportation (aeronautics)
- Process - Welding

Abstract:

STELIA is French aerostructures leader and major worldwide player for design and production of primary structure of aircrafts. STELIA produces every year more than 650 noses and fuselage sections and 6 million elementary parts and panels. For 6 years, STELIA leads research programs dedicated to FSW technology.

Friction Stir Welding is a solid phase joining process commonly used in aluminium industry. Contrary to fusion welding process, FSW allows welding of 7xxx and 2xxx alloys, frequently used in aeronautic industries. Repeatability and low cost are the main qualities which make FSW a good candidate to replace riveted assemblies on aircraft structures. Fastening assembly removal should enable substantial weight and cost saving.

Typical junction area of fuselage is riveted for common commercial aircraft. These junctions are sized by fatigue and damage tolerance criterion, due to pressurization loading, with single-shear or double-shear geometries, and potential overlap.

The use of FSW could be a solution to solve criticality of fuselage junctions due to the proof of its high mechanical properties. Two welding configurations are possible: butt joint welding and lap joint welding. Due to corrosion criteria, butt joint welding is the best configuration.

The main challenge is to prove the viability of FSW to develop an industrial process which takes account of certification and cost aspects. This one includes no defect in welded area, capability of maintenance and no destructive testing to detect possible crack.

Keywords: FSW, Riveted junction, Fuselage, Primary structure

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