Measurement Assisted Robotic Assembly of Fuselage Skin Panels

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Abstract

Geometrically complex structural components are extensively used in the assembly of airframe structures. Currently the application of robotics to the assembly of such structures has been limited and the assembly of aero-structure components is primarily a skilled manual process. The use of manual handling represents a significant health and safety risk and an increased likelihood of damaging components during the assembly process. The compliance of components is significant and the resulting geometric and positional uncertainty within the assembly is such that conventional robotic pick and place approaches cannot be used as it is impossible to pre-define and fix the exact position of parts within the assembly. Using product specific fixtures and templates can solve this problem, but this significantly increases cost and reduces flexibility. This paper addresses the above problems by using a novel combination of standard low cost industrial robots, low cost sensors and a mathematical 'best-fit' algorithm. During the assembly process the location of existing part-to-part holes and edges are measured to provide alignment points for individual components within the structure and the data obtained is processed through a 'best-fit' mathematical algorithm to calculate the relative component positions required for an optimal assembly. The developed methodology has been evaluated and demonstrated using real airframe components and results are presented. The assembly experiments presented have confirmed that it is possible to assemble aero-structure components within aerospace production specifications.

Keyword: *Aero-structure assembly; 'best-fit' assembly; Laser measurement; robotics*