

Automated Fiber Placement With Parallel Robots

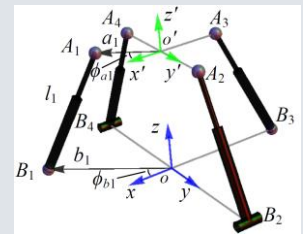
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Introduction

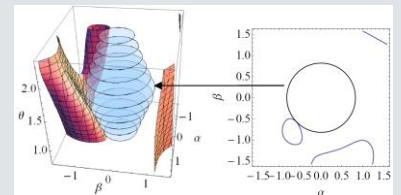
- Automated fiber placement (AFP) is an important manufacturing process in composite aerospace part manufacturing.
- Boeing 787 and Airbus A350XWB contain more than 50% by weight of advanced composite components.
- Robot based AFP offers many advantages: cutting and restarting fiber tows, debulking and consolidation in situ, precise control, high repeatability, flexibility and fabrication of complex structures.
- Serial robots are widely used but generally have low stiffness and large inertia, which affects their force and precision performance in high-compact-force AFP.
- In contrast to serial robots, parallel robots have multiple support limbs with low inertia, high structure stiffness, good positioning accuracy and high speeds.

Optimal Design

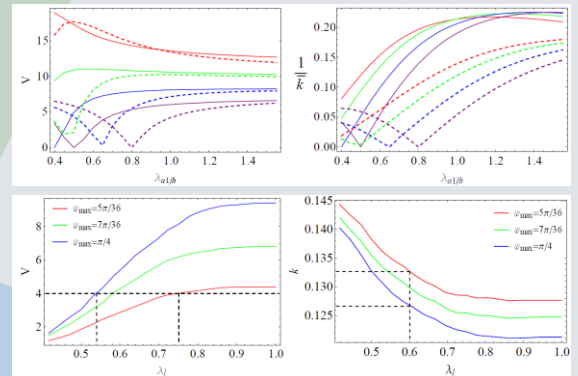
Mechanism Kinematics Modeling



Maximum Singularity-Free Workspace



Optimal Parameter Design

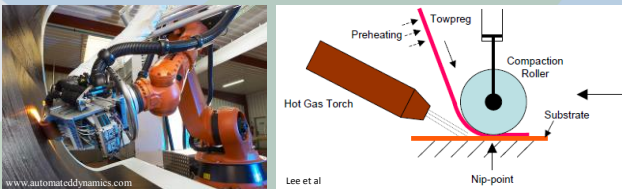


Automated Fiber Placement

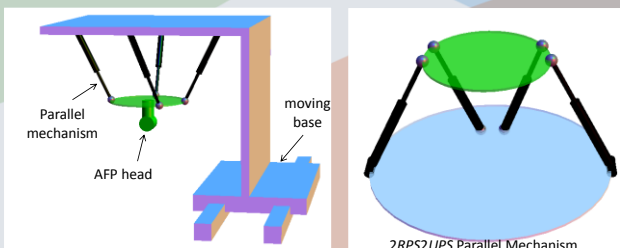
Robotic AFP System



Fiber Placement



Proposed Parallel Robot For AFP



Publications

US Patent

D. M. Gan, J. S. Dai, Jorge Dias, R. Umer, and L. D. Seneviratne, A 2T2R Parallel Mechanism for Automated Fiber Placement, US patent, filed, 2015

Journal Paper

D. M. Gan, J. S. Dai, Jorge Dias, R. Umer, and L. D. Seneviratne, "Singularity-Free Workspace Aimed Optimal Design of a 2T2R Parallel Mechanism for Automated Fiber Placement", Transactions of the ASME: Journal of Mechanisms and Robotics, 7(4), 2015, pp. 041022_1-9.