



Structural Component Additive Repair Robot

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Background

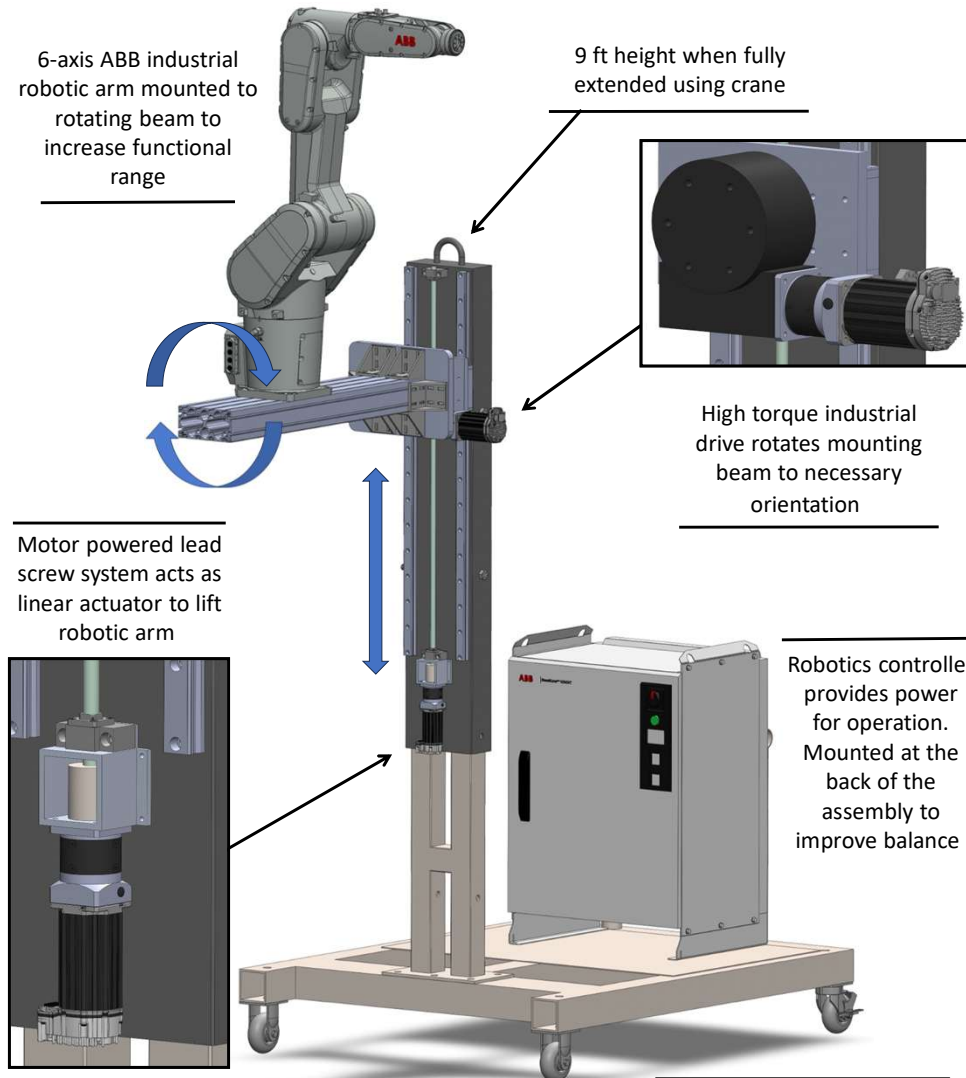
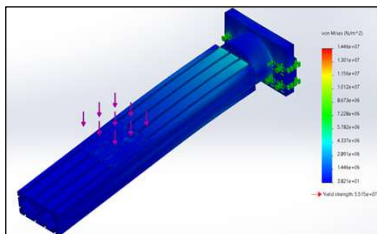
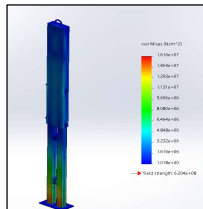
The Structural Component Additive Repair Robot is a mobile robotic system designed to implement technology from the friction stir additive manufacturing (FSAM) research program to aid in aircraft repair. The FSAM process plasticizes metals through friction and axial loading and can deposit them to replace missing material. The project automates FSAM technology to vastly improve repair efficiency.

Capabilities

- Can perform repair operations such as friction stir deposition, grinding, and drilling
- Able to reach and perform repair operations on every part of an aircraft
- Mobile, low profile, and easily maneuverable by a human operator
- Remains rigid and balanced while under force of operation or unexpected loads

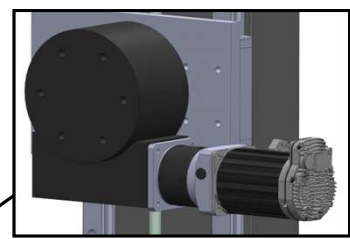
Structural Design & Analysis

- Drive units and gear systems rated to rotate and lift robotic mounting beam in every possible orientation, with a minimum safety factor of 2.9
- FEA simulations prove that structural support components maintain rigidity during all loading cases



6-axis ABB industrial robotic arm mounted to rotating beam to increase functional range

9 ft height when fully extended using crane

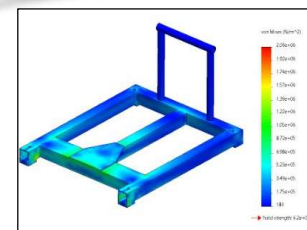


High torque industrial drive rotates mounting beam to necessary orientation

Motor powered lead screw system acts as linear actuator to lift robotic arm

Robotics controller provides power for operation. Mounted at the back of the assembly to improve balance

FEA validated steel frame features industrial strength wheels for mobility, handlebars for transport, and a telescoping pillar that can be adjusted to shrink profile



Motors & Robotics

- ABB robotic arm able to automatically switch between multiple tools during operation
- System dynamics powered by encoder-based actuators with planetary gearbox
- The centralized system controller from ABB allows for process automation



Design for Manufacturing

- Custom parts for component integration designed and manufactured using water jet cutting and milling machines
- System employs modular and replicable design using bolted connections with replaceable and accessible components

Future Work

- Full automated control of structural motor systems with ABB controller
- Assisted motion drivetrain to provide improved system mobility
- Modification of design to operate in various outdoor terrains

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