Automated NonDestructive Inspector of Aging Aircraft

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ABSTRACT

Under the FAA Aging Aircraft Research program (grant # G0319014) we are developing robots to deploy conventional and, later, new-concept NDI sensors for commercial aircraft skin inspection. Our prototype robot, the Automated NonDestructive Inspector (ANDI), holds to the aircraft skin with vacuum assisted suction cups, scans an eddy current sensor and translates across the aircraft skin via linear actuators. Color CCD video cameras will be used to align the robot with a series of rivets we wish to inspect in a linear scan using NDI inspection sensors. In this paper we provide a background scenario and describe two different solutions to the alignment problem: a model-based system built around edge detection and a trainable neural network system.

1.0 BACKGROUND

1.1 Project Goals

The initial goal of the Automated NonDestructive Inspector (ANDI) project is to help the human inspector to work safely, rapidly, and effectively. This will be accomplished by providing the human inspector with a tool that eliminates the need to work in awkward positions or at tedious tasks, and by ensuring that measurements will be accurate and repeatable. A later goal is to improve the productivity of inspection activity by giving the inspector computer-based instrument monitoring and visual observation tools integrated with powerful database and trend-spotting tools that provide support in making judgements and decisions.

Our initial plans include giving the human inspector, who is watching and supervising directly and via TV monitors, a data stream that is at least as reliable as the data stream generated in “hands-on” inspection, to acquire data more rapidly, to identify and mark areas of interest distinctly but removably, and to archive data automatically.

1.2 Mechanical Design

1.2.1 Hardware

Our prototype robot, ANDI, affixes itself to the aircraft skin with vacuum assisted suction cups. In the envisioned fully functional system, electric power, air for the vacuum ejectors, pneumatic actuators, and air-bearings, and input and output signals are transported via an umbilical attached to a safety-tether that hangs from the safety-rail above each aircraft in the maintenance hangar. At the start of an inspection