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6 Degrees of Freedom Dynamic Robot Verification at NASA Marshall Space Flight Center

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ABSTRACT

6 Degrees of Freedom Dynamic Robot Verification at NASA Marshall Space Flight Center

NASA Marshall Space Flight Center had the requirement to verify the performance of two robots used in the simulation testing of docking systems for spacecraft. The robots have 6 degrees of freedom (X, Y, Z plus 3 rotations) in the positioning of their payload section. The requirements for the job included measuring both the location and orientation of the payload section of the robot while the robot was in motion, plus synchronizing these measurements with the robot controller data log. A Leica LTD800 with the T-Probe system was selected because the measurements to the T-Probe contain orientation angles as well as location, and a TTL pulse to the tracker controller can trigger the measurements. The LTD800 acquires a measurement within 20 microseconds of the TTL pulse transition to low for comparison with the robot data. The driven position of the robot was correlated to the laser tracker measurements with a TTL pulse from the robot controller. The LTD800 with a T-Probe can process TTL pulses at up to a 100 Hz rate. NASA developed trajectories with different motions at different speeds. These trajectories tested repeatability, straight-line movement, circles, curves, dwell time, square turns, payload rotations, etc. in support of an ISO9283 evaluation of the robots. The different trajectories were repeated 3, 10 or 30 times at 100%, 50% and 10% of the rated speed with each robot.

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