

Dynamic Evaluation of Six-Axis Robotic Spherical and Extrapolation Measurements Guided by a Laser Tracker

Alexandra E. Curtin, David R. Novotny, Joshua A. Gordon, Ronald Wittmann, Michael Francis, Jeffrey R. Guerrieri

National Institute of Standards and Technology, Boulder, CO

The antenna metrology group at NIST has been using the Configurable Robotic Millimeter Antenna Facility (CROMMA) to perform spherical and extrapolation antenna measurements up to 300 GHz. The CROMMA scan geometries are executed using a six degree-of freedom (6DoF) robotic arm and are measured and corrected using a 6DoF laser tracker system.

The dynamic performance of the system and the stability of the measurements with respect to the speed of the probe antenna is being analyzed. The 6DoF laser tracker has not been formally validated under dynamic movement for any application to date. We are examining the capabilities of the combined laser tracker, robot, and network analyzer measurement system while the antennas are moving at slow speeds.

The simple geometry of the extrapolation measurement offers ways to better quantify the uncertainties of the CROMMA measurements. Phase-vs-distance scans highlight the RF drift with cable movement, and RF data can be correlated with position to help quantify the positional accuracies of the laser tracker. We vary the speed of the measurement to assess the differences between the dynamic and static test results. We believe that using the RF data to verify optical measurement tools may offer new methods to perform dynamic calibrations of laser trackers.