Opportunities for the use of electronic distance measurement instruments in nondestructive testing and structural health monitoring and implications for ASNT

The state-of-the-art for commercially available electronic distance measurement instruments (EDM), commonly known as laser trackers, advanced by quantum leaps in 2004 and 2010. It is now practical to measure 3-D coordinates of targets attached to cardinal points on large-scale structures with an absolute accuracy (traceable to NIST) of the order of one part-per-million, and relative dynamic movements, such as vibrations, typically 10 times better. For example, absolute 3-D coordinates of a structure within a 100 meter cube can be measured within a volume of a 0.1 mm cube (the thickness of a sheet of standard printer paper), and vibrations within a 0.01 mm cube. While this technology has been widely exploited in the manufacturing and aerospace industries, a literature search confirms that it has not yet been generally adopted by the nondestructive testing (NDT) industry. However, due to the unprecedented measurement accuracy, this technology presents opportunities for new methods for NDT. For example, instead of looking for defects as indicators of reduced performance of a structure, one could simply measure the performance of the structure under various loading conditions, and compare the measured performance to finite element models (FEM), or look for salient characteristics such as; linearity, hysteresis, creep, symmetry, damping coefficient, and the like. Moreover, the measurements can be repeated over the life of the structure in a trend analysis. The manufacturing and aerospace industries have adopted the technology from a quality control perspective, i.e., comparing the measured coordinates to the drawings—not from a failure mode perspective. The experience resources of the ASNT Membership are needed to adopt these new methods to NDT.