Design, construction, and calibration of a step gauge of nests for performance evaluation of Laser Trackers

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Abstract

According to documentary standards for the performance evaluation of Laser Trackers (LT), long length reference artifacts are required. We will discuss the design, construction, and calibration of a long length artifact called step gauge of nests (SGN). The SGN has several nests in line to place the LT probe; the two extreme nests of the SGN are at 3 m approximately. However, for long gauges, factors like gravitational force, fixturing forces, change in the environmental conditions, among others, deforms the gauge, and its length changes when its orientation changes. To evaluate these factors, in the design stage, we employ finite element simulation of the SGN to predict such deformations (mainly length variations between the two extreme nests). The simulation considers the used material, its stiffness, straightness, distribution of the nest's weight, and geometry's change of the SGN to reduce the variations in its length. The results of the finite element simulation show a length variation of around 20 ppm between the horizontal and vertical SGN positions. That variation was validated with the calibration results using two different methods. The line of sight (LOS) method, which involves the same LT under evaluation and the Overlap method which uses an accurate CMM.