Development of a gauge for performance testing of XCT

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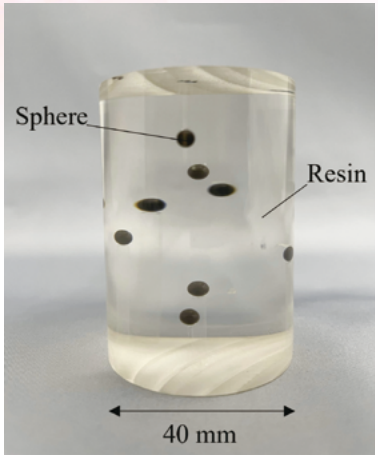
X-ray computed tomography (XCT) stands out as a crucial non-destructive technique for accurately capturing both the external and internal geometrical features of industrial components. To enhance XCT performance testing, we introduced an innovative gauge design, named the Marimo gauge, which incorporates spheres embedded within a cylindrical resin structure. This design is informed by several key considerations aimed at optimizing the gauge performance and compliance with established standards.

The design principles of the Marimo gauge are as follows:

1. Reduction of artifacts: The cylindrical form and the absence of supporting structures ensure uniform X-ray transmission across all rotational positions, significantly minimizing the noise or artifacts that can detract from image quality.
2. Standards compliance: By embedding spheres arbitrarily within the resin, the Marimo gauge aligns with the requirements of both VDI/VDE and ASME standards, making it a versatile tool in industrial metrology.
3. Cost-effectiveness: The gauge can be produced economically, offering a cost-effective solution for XCT calibration needs.
4. Suitability for high-magnification XCT: The ability to manufacture the Marimo gauge with dimensions smaller than 40 mm renders it particularly useful for high-magnification XCT measurements, where precision is paramount.



Performance testing gauge for X-ray computed tomography: the Marimo gauge

The Marimo gauge has been rigorously tested to ensure its utility as a reference standard, focusing on aspects such as the coefficient of thermal expansion and the long-term stability of the resin. Its design enables versatile placement and orientation without the risk of deformation, facilitating calibration through multiple orientation measurements via XCT. The calibration process has demonstrated that the Marimo gauge can achieve measurement uncertainties as low as 3 μm when the center-to-center distance between the spheres is 30 mm.

The development of the Marimo gauge represents a significant advancement in the field of XCT metrology, offering a reliable, standard-compliant, and cost-effective option for the calibration and performance testing of XCT systems.

Reference: M. Watanabe et al., *Precision Engineering* **84**, 15-20, 2023, DOI: 10.1016/j.precisioneng.2023.06.009