MAPAN
Journal of Metrology Society of India

DOI 10.1007/s12647-014-0118-9

Springer

Original Paper

Development and Characterization of a Modified Ring Shaped Force Transducer

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Received: 28 May 2014 / **Accepted:** 19 September 2014 / **Published online:** 28 October 2014

Abstract
The paper discusses the design and development of a force transducer as a modification of the ring shaped force transducer. The investigation includes the analytical, computational and experimental investigations of the force transducer developed. Analytical expressions are developed on the basis of certain assumptions and approximations. Computational tools like finite element analysis and experimental results serve as a measure for validation of analytical studies. The modified ring shaped force transducer of nominal capacity 20 kN has been developed and the metrological investigations of the force transducer have been discussed in the paper. The dial gauge and strain gauges have been used for metrological studies of the force transducer. The strain gauges have been applied to suitable locations. The force transducer has been metrologically investigated according to the calibration procedure based on standard ISO 376–2011 and uncertainty of measurement of force transducer is found up to ± 0.10 % (k = 2), while taking the necessary factors into consideration. A comparison of the metrological performance of some other simple shaped force transducers (like ring shaped and octagonal ring shaped force transducer) of 20 kN capacity has been discussed with modified ring shaped force transducer. This comparison affirms the suitability of the modified ring shaped force transducer for metrological applications related to static force measurement. Further, a close agreement in the findings of analytical, computational and experimental observations has been observed for deflection and the relative deviation is up to 3 % for the deflection obtained by experimental and computational methods.

Keywords
Force transducer – Finite element analysis – Uncertainty – Hexagonal ring