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4. Name of Topic: Design, Development and Analysis of Pressure Calibrator and Associated Components for High Pressure Metrology

5. Keywords: *Metrology; Pressure; FEM; Design; QI*

Abstract:

During the last few decades, the rapid and ever-increasing use of high-pressure technologies in science and engineering has invited researchers' attention to developing better instrumentation and technologies with improved measurement uncertainties over a wide range of applications. Such efforts resulted in the development of new and advanced measurement techniques and standards to address calibration challenges and provide traceability to users. The present investigation aims to design and develop a pressure calibration system and associated high-pressure accessories. To understand the various aspects of metrology, and the traceability of the measurement system, an extensive study on quality infrastructure also has been carried out. A global quality infrastructure index (GQII) has been developed for the inclusive growth of the nations. Two pressure systems based on different principles have been designed, developed and described. In the first system, a strain gauge-based pressure transducer was designed and developed in the pressure range of up to 1000 MPa with the measurement uncertainty of the transducer is found 0.5% at $k=2$. In another system, a novel approach is adopted based on LVDT probes, designed and developed for the first time. The fabricated system is checked for a set of 2 transducers in the range of up to 250 MPa. The estimated measurement uncertainty is found 0.25% at $k=2$ for transducer 1 and 0.23% at $k=2$ for transducer 2. Further in this research, we have designed, developed, and analysed associated high-pressure devices such as cross-floating valves (CFV), pressure chambers, and surface plates.