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Reference Setup for Characterization and Calibration of Low-range Differential Pressure Sensors

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Abstract

In this thesis, a reference setup for the characterization and calibration of low range dierential pressure sensors is presented. The setup utilizes the principle of ideal gas law and actuates on the volume for accurate reference pressure inputs for the calibration process. The error sources for the proposed setup are analysed and an error propagation model is presented. The range of the setup is 320 Pa, with the resolution of 0.001% of full scale. The verified sensitivity of the setup is 0.032 Pa. A complete characterization of a high performance differential pressure transducer is conducted as a test case study for the performance analysis of the proposed setup. During these experiments the sensitivity of the calibration setup to the thermal gradient is observed. To this end, the effects of thermal gradient on the transient response of the setup are also studied, utilizing a comparative experimental study. From the presented experimental study it is concluded that the thermal gradient can cause the system to remain in transient state for at least 96 hours. To reduce this effect, a mechanical design optimization is proposed and a finite element model is presented to be studied in comparison to its preceding design for its thermal performance. From the results it is concluded that the optimized design can reduce the transient time of the measurement system due to thermal gradient, by 11 times. Future work is also proposed to further investigate the optimized model for implementation purposes.

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