A Novel Vortex Flow Meter with MEMS Flow Sensor

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This paper presents the design and experimental results of a novel vortex flow meter that utilizes the MEMS thermal mass flow sensor as the sensing element which is placed inside an unsymmetrical structure of the bluff body. While the fast response MEMS thermal mass flow sensor measures the vortex shedding frequency from the unbalanced differential pressure generated from the turbulence flow via the structure inside the bluff body, it also measures the mass flow rate of the media flowing over passing the sensor. With the proper design of the sensing channel, it is found that the sensor can measure the vortex shedding frequency at its lowest limit of Reynold number of 2300 which is well below the detecting limit by the current existing vortex flow measurement technology, and thus significantly extends the dynamic range of the vortex flow meter to over 160:1. The benefit of the simultaneously acquired mass flow data considerably reduces the cost for conventional addition of temperature and pressure sensor for compensation. Further, by comparison between the measured volumetric and mass flowrate it also provides the capability to alert if the composition of the flow media changes. In another words, the mass flow data can also be used for the density metrology that allows the possibility to substantially improve the measurement accuracy for media like steam.