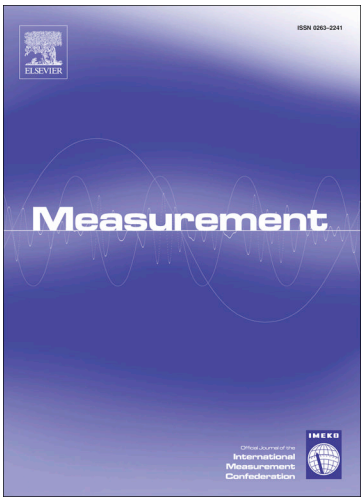

Quartz crystal sensor using direct digital synthesis for dew point measurement

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Quartz crystal sensor using direct digital synthesis for dew point measurement

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Abstract: Considering that the quartz crystal resonant (QCR) sensor with the oscillation circuit as a driver will stop oscillation when it encounters a large damping medium. A QCR sensor excitation method based on direct digital synthesis (DDS) was presented in this paper. Meanwhile, a fast frequency tracking algorithm based on variable step size and variable interval was designed. The designed excitation and frequency measurement method was integrated into a complete frequency excitation and tracking system by microprocessor and the system was applied to the dew point sensor. Firstly, the accuracy and reliability of the frequency tracking system was validated, the frequency identification results has a relative error of 0.97Hz compared with the Agilent 4294A impedance analyzer. Secondly, the sensor was tested in the range of 0~20℃ dew point temperature (DP), and the dew point was identified by judging the frequency shift. The maximum error was 0.3℃ DP compared with the MICHELL S4000 dew point meter. The results showed that the dew point resonant sensor based on the frequency excitation and tracking system has fast and accurate characteristics in dew point identification and measurement, and can overcome the disadvantage of stop oscillation when it encounters a large damping medium.

Keywords: Dew point sensor, humidity, quartz crystal resonator, direct digital synthesis.

1. Introduction

Quartz Crystal resonant (QCR) sensor has found numerous applications in many fields including thin-film measurement, chemical analysis [1], gas sensor [2], humidity sensor [3-4], and biosensor [5]. QCR is a principle that very attractive for humidity or dew point sensing applications as they employ the most basic physical effect, which