

Application of an Ultrasonic Delay-Line Oscillator for the Measurement of Minute Changes in Physiological Salt Concentrations

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A system used to measure the concentration of a minute amount of physiological salt solution has been developed using an interdigital transducer (IDT). Measurements are accomplished via a liquid delay-line oscillator consisting of a minute amount of sample medium where an IDT is operated at a solid liquid interface. The system consists of two liquid delay-line oscillators; one of the liquids is a reference while the second is a sample whereby detecting the difference in the oscillation measurements, real time measurements of concentrations of minute amounts of liquid have been accomplished. In the measurement of a 0.05 cc salt solution of a mixture of NaCl and KCl, the sensitivity at a frequency of 50 MHz was 1.87×10^3 Hz/mmol and 2.11×10^3 Hz/mmol, respectively. The resolution of the measurement was 0.01 mmol when the temperature of the solution was maintained within $\pm 0.01^\circ\text{C}$.

1. Introduction

Since the measurement of biochemical quantities is viewed as one of the most important factors in the field of Medical Electronics, the techniques used for this purpose have progressed rapidly. There are many methods used to measure these quantities, such as the traditional chemical reaction and the spectrometric methods. In addition, there are direct electronic methods utilizing enzyme sensors and semiconductor sensors.^(1,2) Both simplified procedures and methods capable of measuring various amounts of a sample at high speed and with a high level of accuracy are required in clinical and laboratory situations. Considering these circumstances, the