Sensors and Materials, Vol. 7, No. 1 (1995) 043-051
MYU Tokyo

S & M 0185

Study of Flow Sensor Using Finite Difference Method

Sekwang Park, Hyungpyo Kim and Yunseok Kang

Department of Electrical Engineering, Kyungpook National University
1370 Buk-Ku, Sankyuk-Dong, Taegu 702-701, Korea

(Received April 15, 1994; accepted August 3, 1994)

Key words: flow sensor, simulation, finite difference method, gas and liquid

This paper presents a sensor design technique by means of simulation using the finite difference method, which can be applied to determine optimal parameters of the sensor (for example, the resistance value of the sensor and feedback gain) for various fluids and ranges of flow velocity. As an example, a sensor is designed, fabricated and tested with parameters which were determined by simulation for water and air. In the experimental result, sensitivity is 111 mV/(m/s) in the range of flow velocity of 2–9.7 m/s for air, and is 16 mV/(cm/s) in the range of flow velocity of 0–80 cm/s for water. Response time is less than four seconds. The result of this research offers optimal parameters for fluid conditions in the design of a thermal flow sensor which can be used as an industrial flowmeter, an automobile flow sensor to measure the flow rate of air or fuel, a mass flow controller (MFC), and in medical applications.

1. Introduction

The most popular class of silicon-based flow sensors to date is the thermal sensor. The overall benefits of simulation are a reduction in global development time of the device as well as a significant reduction of the development cost. Similar benefits can be applied to silicon sensor design if suitable models are developed through simulation. Key parameters for flow sensors are response time, sensitivity, stability and power consumption.[1-3] The relative importance of these parameters varies for different applications. Therefore the purpose of this paper is to introduce the optimal design of a sensor by means of computer simulation using the finite difference method.