

Application of New Tactile Sensor for Detecting Hardness in Factory Automation

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(Received January 11, 1993; accepted March 29, 1993)

Key words: PZT, piezoelectric, hardness, tactile sensor

In factory automation, especially for food processing, there are many demands for inspecting and controlling the quality of hardness. However, there is no sensor which can easily measure hardness of foods. Hence we have developed a new hardness tester to be used in factory automation and applied it to the measurement of food hardness. As a result, it was demonstrated that this prototype can measure the hardness of foods such as *tofu*, *konnyaku*, and bread. Therefore, this hardness tester can be used for examination and quality control in food processing.

1. Introduction

There are many demands for inspecting and controlling hardness in food processing, for example, quality control and examination of *tofu*, *konnyaku*, and boiled fish pastes. However, there is no sensor which can easily measure hardness of foods. For metals, general standards for measuring hardness are already established, such as the Rockwell hardness test and Vickers hardness test. For soft objects like food, however, there is no method for testing hardness except to use a rubber hardness tester; however, most foods are so much softer than rubber, that even a rubber hardness tester encounters difficulty in measuring food. Therefore, developing a sensor for measuring food hardness is very important, because such a sensor will be able to replace the portion of quality management which currently relies solely on human senses. In the past, we developed a novel tactile sensor using piezoelectric ceramics,