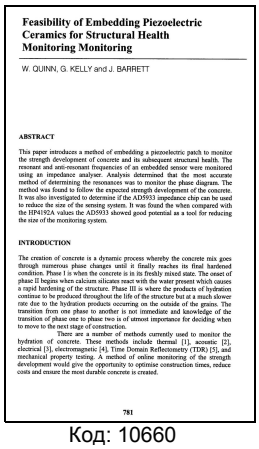

Feasibility of Embedding Piezoelectric Ceramics for Structural Health Monitoring Monitoring

W. QUINN, G. KELLY and J. BARRETT

ABSTRACT

This paper introduces a method of embedding a piezoelectric patch to monitor the strength development of concrete and its subsequent structural health. The resonant and anti-resonant frequencies of an embedded sensor were monitored using an impedance analyser. Analysis determined that the most accurate method of determining the resonances was to monitor the phase diagram. The method was found to follow the expected strength development of the concrete. It was also investigated to determine if the AD5933 impedance chip can be used to reduce the size of the sensing system. It was found the when compared with the HP4192A values the AD5933 showed good potential as a tool for reducing the size of the monitoring system.

INTRODUCTION

The creation of concrete is a dynamic process whereby the concrete mix goes through numerous phase changes until it finally reaches its final hardened condition. Phase I is when the concrete is in its freshly mixed state. The onset of phase II begins when calcium silicates react with the water present which causes a rapid hardening of the structure. Phase III is where the products of hydration continue to be produced throughout the life of the structure but at a much slower rate due to the hydration products occurring on the outside of the grains. The transition from one phase to another is not immediate and knowledge of the transition of phase one to phase two is of utmost importance for deciding when to move to the next stage of construction.

There are a number of methods currently used to monitor the hydration of concrete. These methods include thermal [1], acoustic [2], electrical [3], electromagnetic [4], Time Domain Reflectometry (TDR) [5], and mechanical property testing. A method of online monitoring of the strength development would give the opportunity to optimise construction times, reduce costs and ensure the most durable concrete is created.

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Ключевые слова:

Содержание.