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Abstract

Piezoelectric film sensors such as polyvinylidene flouride (PVDF) generate an electrical voltage in response to an applied mechanical stress with a remarkably high sensitivity. They provide very fast response times and do not require extensive signal conditioning. This paper presents a straightforward method of measuring the speed of sound in solid materials and structures using commercial PVDF sensors.

PVDF sensors are most commonly used to measure stresses applied in the sensors' thickness direction. However, this requires that the sensors be located in the load path, which may result in damage to the sensor or affect the response of the system. In this paper, two PVDF sensors are bonded to the side of a structure and a small impact is applied to one end. The sensors are used to measure the time for the impact-induced plane stress wave to travel between the sensors. The observed speed of the propagating stress wave is shown to be in good agreement with the theoretical speed of sound for the material and finite element calculations. In addition, the finite element simulations confirm the validity of the plane wave assumption for non-ideal and non-uniform impact inputs.

Keywords

Solids, Sensors, Speed of sound