**Kotian, K.,** Headings, L., and Dapino, M., Stress Averaging in PVDF Sensors for in-Plane Sinusoidal and Impact-Induced Stresses, IEEE Sensors Journal, Vol. 13, No. 11, (2013), 4444-4451

## Abstract

Polyvinylidene flouride (PVDF) sensors are shown to exhibit very high stress sensitivity and high speed operation, with nanosecond response times. These characteristics allow PVDF sensors to measure in-plane stress waves in a structure. The voltage output of these sensors can be related to the average stress acting on the sensor. This paper presents an analysis on the effects of stress averaging for both in-plane sinusoidal stress waves and in-plane impact-induced stresses. Analytical models are developed that show the relationship between measured PVDF output voltage and sensor parameters, structure material, and input stress conditions. Parametric studies are conducted, which show that the error introduced by stress averaging is minimal for most typical cases; however, the effects of stress averaging become more significant as the sensor length increases, density of the structure's material increases, and magnitude of the input stress increases. For sinusoidal stress inputs, the error increases as the sensor length.

**Keywords**

Stress averaging, PVDF sensor, In-plane stress, Impact testing