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Calibration of resonant piezoelectric sensors and broadband piezoelectric sensors for elastic waves

Hironori Kawakata^{1*}, Nana Yoshimitsu¹, Takaya Okuno¹

¹Ritsumeikan University

During rock fracture experiments in a laboratory, piezoelectric sensors are generally used to measure elastic waves. Piezoelectric sensors can be roughly classified into resonant sensors and broadband sensors. In addition that a resonant sensor has only a narrow frequency band, the oscillation is apparently kept on, so that the waveform can not be directly used for waveform analysis. On the other hand, a broadband sensor has a damper on the back of resonant piezoelectric element so that sensitive frequency band becomes wide, and the apparent lasting oscillation is reduced, though it is less sensitive. However, the pressure resistance of usual broadband sensors is too low to use under triaxial compressive conditions above 10MPa.

We examine the amplitude and phase responses of resonant sensors and broadband sensors. Using a laser Doppler vibrometer (LDV), we applied a similar approach to Theobald et al. (2009), and also examined response of sine waves to calibrate sensors.

Keywords: piezoelectric sensors, calibration, resonant oscillation, broadband, amplitude response, phase response