Title	Seismometer calibration by harmonic drive
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If the seismometer possesses an auxiliary magnet and coil assembly, the calibration can be carried out with the aid of an electric current. According to Eq. (5.25) in Chapter 5 and related discussion a current i_s acts in the same way as a ground acceleration

$$\frac{d^2 x_e}{dt^2} = \frac{G_{S2} l_0^{\,2}}{K_S} i_S \ . \tag{1}$$

where G_{S2} is the electrodynamic constant of the auxiliary coil (given in [*Vs/m*]. For other constants see EX 5.2 *Estimating seismometer parameters by STEP function*. It corresponds to a harmonic drive of frequency f with an equivalent ground displacement

$$x_e = \frac{G_{S2} l_0^{\,2}}{4\pi^2 f^2 K_S} i_S \ . \tag{2}$$

For a translational seismometer, for example a geophone, with seismic mass m_s, the equivalent seismic displacement is

$$x_e = \frac{G_{S2}}{4\pi^2 f^2 m_S} i_S \ . \tag{3}$$

Since the output voltage of a geophone with an electromagnetic transducer is

$$E_S = G_{S1} \frac{dz}{dt} \ , \tag{4}$$

where z is the displacement of the seismic mass, G_{S1} is the electrodynamic constant of the signal coil and f_s the natural frequency, one obtains for a harmonic excitation

$$E_S = \frac{G_{S1} G_{S2} f}{2\pi m_S \sqrt{(f^2 - f_S^{\,2})^2 + 4 D_S^{\,2} f^2 f_S^{\,2}}} \ . \tag{5}$$

Changing the frequency of the exciting current the output voltage attains a maximum at $f = f_s$. This can be used to determine the natural frequency and the damping using an oscilloscope.