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

$$\frac{d^2 x_e}{dt^2} = \frac{G_{S2}l_0^2}{K_s} i_s .$$ (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

$$x_e = \frac{G_{S2}l_0^2}{4\pi^2 f^2 K_s} i_s .$$ (2)

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

$$x_e = \frac{G_{S2}l_0^2}{4\pi^2 f^2 m_s} i_s .$$ (3)

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

$$E_s = G_{S1} \frac{dz}{dt} ,$$ (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

$$E_s = \frac{G_{S1}G_{S2}f}{2\pi m_s \sqrt{(f^2 - f_s^2)^2 + 4D_s^2 f^2 f_s^2}} .$$ (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.