**Introduction**

Inertial seismometers such as the VBB and SP sensors in the InSight/SEIS instrument package (Lognonné et al., 2018) convert ground motion into an electrical signal. The sensitivity of the seismometers is frequency dependent and in order to estimate this frequency dependence each of the six seismometer components of SEIS is equipped with calibration coils. An electrical current flowing through the calibration coil exerts a force on the seismometer proof mass similar to a ground acceleration. A calibration experiment then consists in injecting a known electrical current in the coil (input) and recording the response of the seismometer (output). By modeling the transfer function between input and output the frequency response of the seismometer can be estimated.

 Ideally a seismometer behave as a linear system. However real-life mechanical and electrical components exhibit also a small non-linear response. On this poster we evaluate the linear part of the VBB and SP instrument response and inspect the residues for evidence of a non-linear component to the response.

The VBB calibration signal consists of a down-sweep from 5Hz to 0.5Hz and thus only allows a characterization of the VBBs in this band. Furthermore the time-domain amplitude of the initial, high frequency response is small such that this part of the transfer function will be ill constrained if estimated with a least-squares procedure. On this poster we ignore the high frequency roll-off and model only the response in the pass-band and the low-frequency corner. We use impulse-invariant recursive Schuster-filters for the modeling in the time domain (Wielandt & Forbriger, 2016).

**Conclusions**

We have evaluated all calibrations of the SP and VBB seismometers (both VEL and POS channels). Both VBB and SP sensor calibrations can be modeled with a simple second order system with only three free parameters: gain, \(A\), corner period, \(T_c\), and fraction of critical damping, \(h\).

VBB calibrations conducted at -54C, -45C and -35C reveal no temperature dependence of the (linear part of the) transfer function. The residues obtained in modeling the sweep calibrations conducted on Mars are large compared to the seismic background noise and are correlated with the input signal. This indicates that a linear model is insufficient to fully describe the seismometer response.

All three VBBs show a small non-linear distortion with odd symmetry. This is true both for the VEL and POS channels. Frequency calibrations of the SEIS flight unit conducted in 2017 at CNES in Toulouse (not shown) did not reveal any non-linear response presumably because the CNES vault is too contaminated by anthropogenic noise.

For the SP1 seismometer (fig. 5) the residue is dominated by a signal approx. 90° out of phase with the linear model prediction: an (as yet unidentified) unmodeled inductance or capacitance could be generating such a residue. At this time we are unable to identify the culprit of the VBB non-linearities: both mechanical and electronic components may be responsible. Since the calibration current has not been measured and we only know the digital input to the D/A-converter, the non-linearity may also originate from the D/A-converter. Detailed experiments with the flight spare conducted in a seismically quiet vault may lead to a better understanding.

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**References**


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