STS-2.5 POLES & ZEROES

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Upper frequency band (> 1 Hz) transfer function STS-2.5

Proceeding for evaluation:
- Pole-Zero data fit* of a measured calibration curve (excitation through the feedback coil).
- Pole-Zero data fit* of the simulated ratio: (TF excited by ground motion)/(TF excited through feedback coil).
- Combining the two pole-zero fits
*Evaluated by tryal-and-error

$$n := 1 .. 500 \qquad f_n := 0.2 \cdot n \qquad \omega_n := 0.4 \cdot \pi \cdot n$$

Pole-zero fit to the measured calibration curve (normalized for 1500 V*s/m)

Zero: $\qquad z_1 := 2 \cdot \pi \cdot 1.5$

Single Pole: $\qquad p_1 := 2 \cdot \pi \cdot 1.55$

Double Pole: $\qquad pre_2 := 2 \cdot \pi 35 \qquad pim_2 := 2 \cdot \pi \cdot 22$

Double Pole: $\qquad pre_3 := 2 \cdot \pi \cdot 35 \qquad pim_3 := 2 \cdot \pi \cdot 109$

$$G_{fit_n} := \frac{1500 \cdot p_1 \cdot \left(pre_2{}^2 + pim_2{}^2\right) \cdot \left(pre_3{}^2 + pim_3{}^2\right)}{z_1} \cdot \frac{i \cdot \omega_n + z_1}{\left(i \cdot \omega_n + p_1\right) \cdot \left(i \cdot \omega_n + pre_2 + i \cdot pim_2\right) \cdot \left(i \cdot \omega_n + pre_2 - i \cdot pim_2\right) \cdot \left(i \cdot \omega_n + pre_3 + i \cdot pim_3\right) \cdot \left(i \cdot \omega_n + pre_3 - i \cdot pim_3\right)}$$

$$A_{fit_n} := \left| G_{fit_n} \right| \qquad\qquad \Phi_{fit_n} := \frac{180}{\pi} \cdot arg\left(G_{fit_n}\right)$$

Inverse filter for conversion to ground excitation
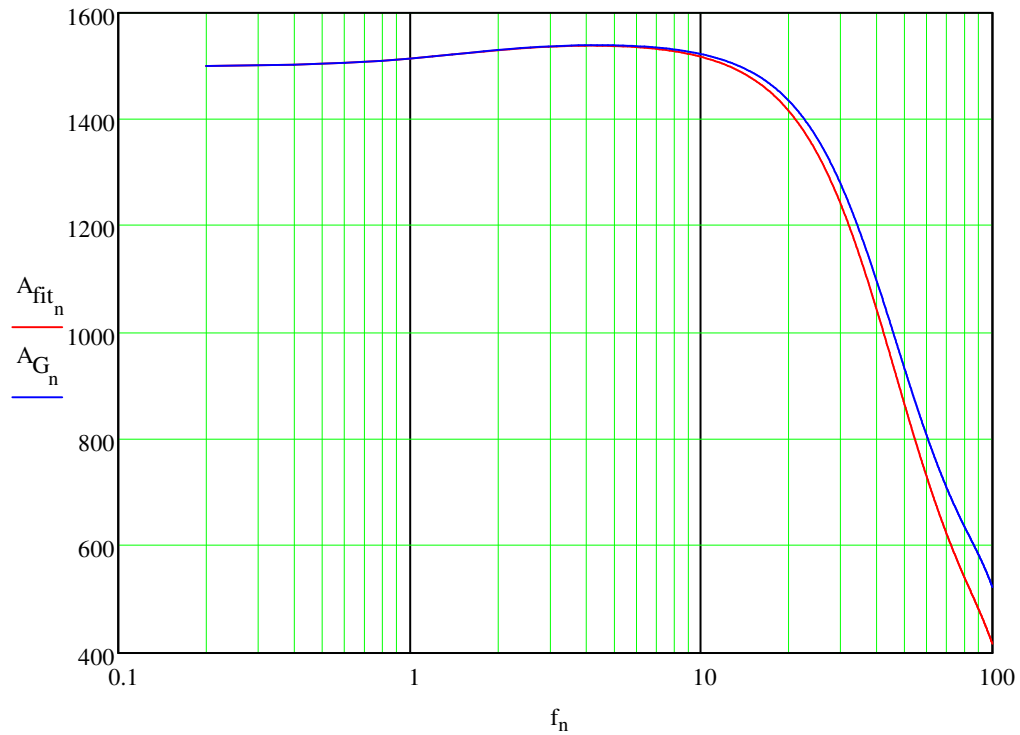
$$p_x := 2 \cdot \pi \cdot 180$$

$$h_x := 0.5$$

$$p_y := 2 \cdot \pi \cdot 100$$

$$IF_n := \frac{\left[p_x^2 + 2 \cdot h_x \cdot p_x \cdot i \cdot \omega_n - (\omega_n)^2\right] \cdot (p_y + i \cdot \omega_n)}{p_x^2 \cdot p_y}$$

Combined transfer function representing the response to ground motion

$$G_{G_n} := G_{fit_n} \cdot IF_n \qquad A_{G_n} := \left| G_{G_n} \right| \qquad \Phi_{G_n} := \frac{180}{\pi} \cdot arg\left(G_{G_n}\right)$$

Coil (red), Ground (blue) excitation - Amplitude

Coil (red), Ground (blue) excitation - Phase