# White Paper No. 3
## Driving vibration exciters

### Task

Two vibration exciters with an impedance of Z = 4 Ohm + 1.6 mH are to be actuated by one power amplifier each with constant current (maximum 8 $A_p$, gain = 1 V / 1 A) ) in a frequency range from 10 Hz to 500 Hz. The phase shift between output voltage and output current must not exceed +/- 2° and the amplitude response of the amplifiers should be nearly identical (difference < 0.05 dB).

### Solution

The required voltage at the maximum operating frequency is calculated from the known impedance and the required maximum current.

$$U_p = I_p * |Z| = 8 * 6{,}42 = 51{,}4\,[V_p]$$

Consequently, the required power amplifier must be capable of providing a minimum output voltage of 52 $V_p$ and an output current of minimum 8 $A_p$ if operated as current amplifier. The reactive load results in a maximum phase shift of 52° at 500 Hz, so that the amplifier must provide safe operation both as source and as sink (see also: White Paper No. 1: HUBERT 4-quadrant amplifiers).

Two A1110-05-E 4-quadrant amplifiers from the HUBERT range of amplifiers, which are capable of operating in current mode, were selected. Two slightly different compensation networks (CN1, CN2) were developed for the current amplifier controller, which can be selected by the A1110-E-Control application software.

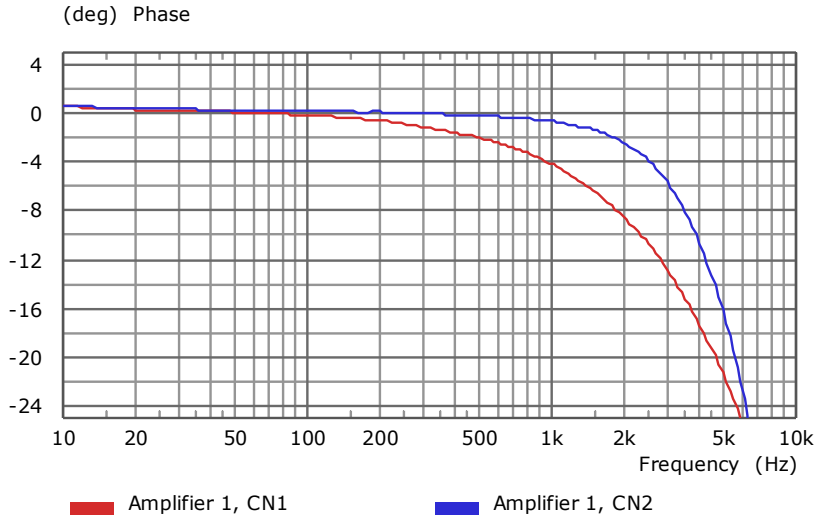


Figure 1: Current Phase Response

Figure 1 shows the current-phase characteristic of an A1110-05-E at different compensations CN1 and CN2 at a reactive load (vibration exciter). The red graph precisely complies with the requirements; the blue graph only reaches the required limit value at approx. 1.8 kHz. In other words: At 500 Hz the phase shift is < 0.5° and consequently far from the required 2°.

However, this is a small price to pay as can be seen in Figure 2.

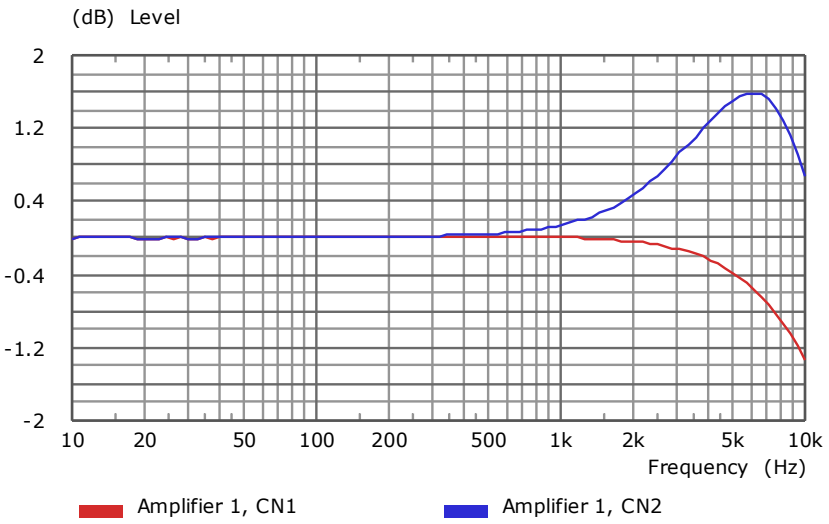


Figure 2: Current Amplitude Response

The figure illustrates the current-amplitude characteristic standardized to 0 dB. The red graph displays a gentle drop from 2 kHz, whereas the blue graph rises from approx. 700 Hz. The decision in how far the “overshoot” at approx. 6 kHz is acceptable lies with the user. Stable operation of the power amplifier is ensured with both networks.

Compliance with the required “synchronized operation” of the two current amplifiers makes the difference of the current-amplitude characteristics shown in Figure 3 even clearer.

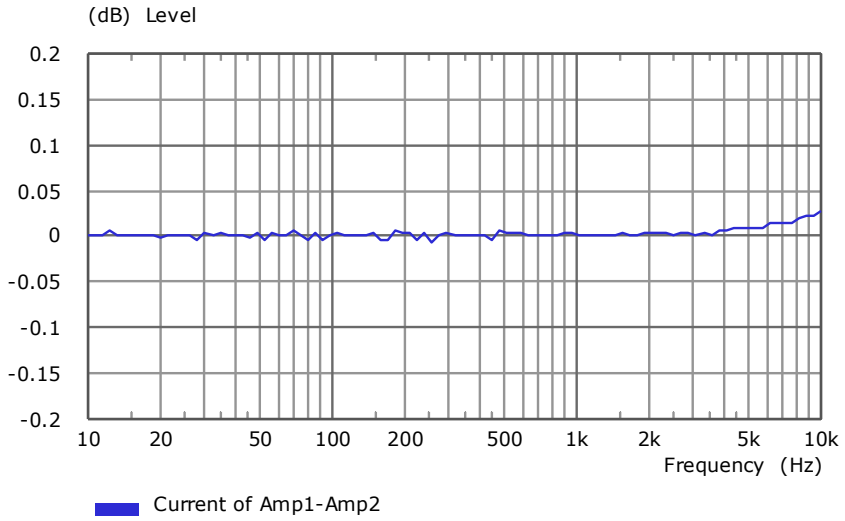


Figure 3: Difference Current Amplitude Response of Amp1 and Amp2

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