For problems 2, 3, and 4, find the transfer functions for the given circuits. Reduce your functions to rational polynomials:

\[ H(\omega) = \frac{a_m (j\omega)^m + \ldots + a_1 (j\omega) + a_0}{b_n (j\omega)^n + \ldots + b_1 (j\omega) + b_0} \]

Do not factor into “standard form”.

2. P 13.2-2, modified. (a) Let \( \hat{V}_a(\omega) \) be the voltage across the 160 kohm resistor (“+” at the top node). What is the transfer function \( \hat{H}_a(\omega) = \hat{V}_a(\omega)/\hat{V}_i(\omega) \)? (b) Let \( \hat{V}_b(\omega) \) be the voltage across the 0.025 \( \mu \)F capacitor (“+” at the top node). What is the transfer function \( \hat{H}_b(\omega) = \hat{V}_b(\omega)/\hat{V}_i(\omega) \)?

3. Find the transfer function \( \hat{H}(\omega) = \hat{V}_o(\omega)/\hat{V}_i(\omega) \) for the circuit in Figure P3.

4. Find the transfer function \( \hat{H}(\omega) = \hat{V}_o(\omega)/\hat{V}_i(\omega) \) for the circuit in Figure P4.

5. Determine the magnitude (in dB, “20 \log_{10}(\ )”) and phase in degrees for the transfer function \( H(\omega) = \frac{100}{40 + j\omega} \) at radian frequencies (a) \( \omega = 2 \) rad/s; (b) \( \omega = 20 \) rad/s; (c) \( \omega = 40 \) rad/s; (d) \( \omega = 80 \) rad/s; (e) \( \omega = 800 \) rad/s.