Jaeger 3rd ed

(16.5)

$$A_v(s) = \frac{s + 3e9}{(s+10^7)\left(1+\frac{s}{10^9}\right)} = \frac{3e9}{} \quad \frac{1+\frac{s}{3e9}}{\left(1+\frac{s}{10^7}\right)\left(1+\frac{s}{10^9}\right)}$$

(a)
$$= \underbrace{[300]}_{A_{mid}} \underbrace{\left[\frac{\left(1+\frac{s}{3e9}\right)}{\left(1+\frac{s}{10^7}\right)\left(1+\frac{s}{10^9}\right)}\right]}_{F_H(s)}$$

(b) The dominant pole is at -10^7 rad/s

(c) $$A_v(s) \cong 300 \frac{1}{1+\frac{s}{10^7}}$$

(d) $$f_H \cong \frac{10^7}{2\pi} = 1.59 \text{ MHz} \quad \text{(approx)}$$

(e) Exact f_H

$$\frac{1}{2} = \frac{1+\frac{\omega_H^2}{9e18}}{1+\frac{\omega_H^2}{10^{14}}} \quad \frac{1}{1+\frac{\omega_H^2}{10^{18}}}$$

$$0 = \omega_H^4 + \omega_H^2\left[1.0 \times 10^{18}\right] - 10^{32}$$

$$\omega_H^2 = 99.98 \times 10^{12} \quad \text{OR} \quad -1.0 \times 10^{18}$$

$$\omega_H = 9.999 \times 10^6$$

$$f_H = 1.59 \text{ MHz} \quad \text{(exact)}$$