Example

$$KG(s) = \frac{K}{s(s^2 + 2s + 2)}$$

Characteristic equation:

$$1 + \frac{K}{s(s^2 + 2s + 2)} = 0$$
$$s(s^2 + 2s + 2) + K = 0$$
$$s^3 + 2s^2 + 2s + K = 0$$

Recall the necessary & sufficient condition for stability for a 3rd-degree polynomial $s^3 + a_1 s^2 + a_2 s + a_3$:

$$a_1, a_2, a_3 > 0, \qquad a_1 a_2 > a_3.$$

Here, the closed-loop system is stable if and only if $0 < K < 4$.

Let's see what we can read off from the Bode plots.