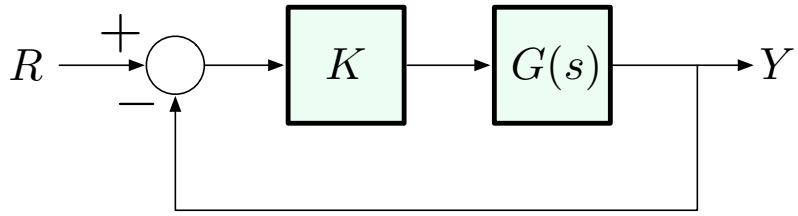
Stability from Frequency Response



Question: How can we decide whether the *closed-loop* system is stable for a given value of $K > 0$ based on our knowledge of the *open-loop* transfer function $KG(s)$?

One answer: use root locus.

Points on the root locus satisfy the characteristic equation

$$1 + KG(s) = 0 \qquad \Longleftrightarrow \qquad KG(s) = -1 \qquad \left(\Longleftrightarrow G(s) = -\frac{1}{K} \right)$$

If $s \in \mathbb{C}$ is on the RL, then

$$|KG(s)| = 1 \qquad \text{and} \qquad \angle KG(s) = \angle G(s) = 180^\circ \mod 360^\circ$$