Rule A: Number of Branches

$$1 + K\frac{b(s)}{a(s)} = 1 + K\frac{s^m + b_1 s^{m-1} + \ldots + b_{m-1}s + b_m}{s^n + a_1 s^{n-1} + \ldots + a_{n-1}s + a_n} = 0$$

$$\begin{aligned} \Longrightarrow (s^n + a_1 s^{n-1} + \ldots + a_{n-1}s + a_n) \\ + K(s^m + b_1 s^{m-1} + \ldots + b_{m-1}s + b_m) = 0 \end{aligned}$$

Since $\deg(a) = n \geq m = \deg(b)$, the characteristic polynomial $a(s) + Kb(s) = 0$ has degree n.

The characteristic polynomial has n solutions (roots), some of which may be repeated. As we vary K, these n solutions also vary to form n branches.

Rule A:

$$\#(\text{branches}) = \deg(a)$$