Rule D: Real Locus

The branches of the RL start at the open-loop poles. Which way do they go, left or right?

Recall the phase condition:

$$1 + KL(s) = 0 \qquad \Longleftrightarrow \qquad \angle L(s) = 180^\circ$$

$$\begin{aligned}
\angle L(s) &= \angle \frac{b(s)}{a(s)} \\
&= \angle \frac{(s - z_1)(s - z_2) \ldots (s - z_m)}{(s - p_1)(s - p_2) \ldots (s - p_n)} \\
&= \sum_{i=1}^{m} \angle (s - z_i) - \sum_{j=1}^{n} \angle (s - p_j)
\end{aligned}$$

— this sum must be $\pm 180^\circ$ for *any* s that lies on the RL.