The Routh–Hurwitz Criterion

Consider degree-n polynomial

$$p(s) = s^n + a_1 s^{n-1} + \ldots + a_{n-1} s + a_n$$

and form the Routh array:

$$\begin{array}{rccccc}
s^n: & 1 & a_2 & a_4 & a_6 & \ldots \\
s^{n-1}: & a_1 & a_3 & a_5 & a_7 & \ldots \\
s^{n-2}: & b_1 & b_2 & b_3 & \ldots & \\
s^{n-3}: & c_1 & c_2 & \ldots & & \\
\vdots & & & & & \\
s^1: & * & * & & & \\
s^0: & * & & & &
\end{array}$$

The Routh–Hurwitz criterion: Assume that the necessary condition for stability holds, i.e., $a_1, \ldots, a_n > 0$. Then:

- p is stable if and only if all entries in the first column are positive;
- otherwise, #(RHP poles) = #(sign changes in 1st column)