

Routh-Hurwitz Test

Mechanical Engineering

Deciding stability from the characteristic polynomial, without finding roots.

It counts unstable roots. It does not tell you where they are.

1

Write the characteristic equation

Set $1 + G(s)H(s) = 0$ and clear it to a polynomial in s .

2

Try the quick necessary test

Any missing or negative coefficient means it is already unstable.

3

Build the array

Two rows from the coefficients, then compute each row below them.

4

Count the sign changes

Each sign change in the first column is one unstable root.

5

Solve for the gain limit

Set the critical row to zero to find the marginal gain.

Necessary and sufficient for a polynomial with real coefficients. A whole zero row means roots on the axis.