

A Necessary Condition for Stability

Terminology: we say that A is a **necessary condition** for B if

$$A \text{ is false} \implies B \text{ is false}$$

Important!! Even if A is true, B may still be false.

Necessary condition for stability: a polynomial p is strictly stable only if all of its coefficients are strictly positive.

Proof: suppose that p has roots at r_1, r_2, \dots, r_n with $\operatorname{Re}(r_i) < 0$ for all i . Then

$$p(s) = (s - r_1)(s - r_2) \dots (s - r_n)$$

— multiply this out and check that all coefficients are positive.