Negative Feedback

Electrical Engineering

Analogue design's core trade: raw gain for accuracy and bandwidth.

Negative feedback trades open-loop gain for accuracy, bandwidth and predictability.

$$A_{cl} = A/(1 + A\beta) \cdot A_{cl} \to 1/\beta \text{ when } A\beta \text{ is large}$$

A = 100000, β = 0.01 — **A_cl ≈ 100**

Set by β alone.

Open-loop gain halves — **A_cl moves 0.05%**

Desensitised.

Gain × bandwidth — **Stays constant**

Less gain, more band.

THE COMMON MISTAKE

× **Assuming more feedback is always safer**

✓ **Checking phase margin at the crossover**

Accumulated phase lag turns negative feedback positive somewhere. If loop gain still exceeds one there, the circuit oscillates.

Feedback cuts distortion generated inside the loop by roughly the loop gain. Noise arriving at the input is amplified with the signal.