P063

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Analysis and Design of Operational Amplifier Stability Based on Control Theory

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Stability of operational amplifier with feedback

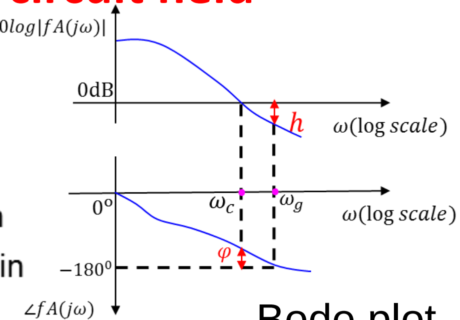
Signal expression *Laplace / Fourier transform*

Time domain → Frequency domain

Electronic circuit field

h: Gain Margin

φ: Phase Margin



Bode plot

Control theory field

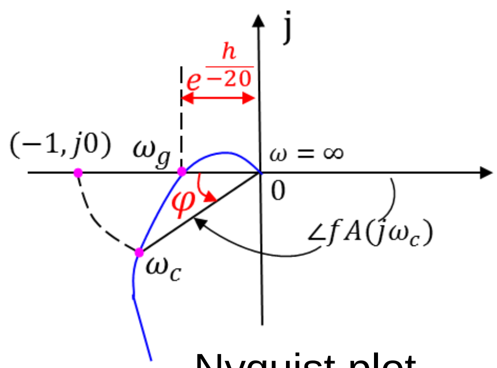
s $j\omega$

Routh-Hurwitz stability criterion

s^n	α_n	α_{n-2}	α_{n-4}	α_{n-6}	⋯
s^{n-1}	α_{n-1}	α_{n-3}	α_{n-5}	α_{n-7}	⋯
s^{n-2}	$\beta_1 = \frac{\alpha_{n-1}\alpha_{n-2} - \alpha_n\alpha_{n-3}}{\alpha_{n-1}}$	$\beta_2 = \frac{\alpha_{n-1}\alpha_{n-4} - \alpha_n\alpha_{n-5}}{\alpha_{n-1}}$	β_3	β_4	⋯
s^{n-3}	$\gamma_1 = \frac{\beta_1\alpha_{n-3} - \alpha_{n-1}\beta_2}{\beta_1}$	$\gamma_2 = \frac{\beta_1\alpha_{n-5} - \alpha_{n-1}\beta_3}{\beta_1}$	γ_3	γ_4	⋯
⋮	⋮	⋮	⋮	⋮	⋮
s^0	α_0				

Routh table

Nyquist stability criterion



Nyquist plot

Innovation

Nyquist (Electronic circuit)

Routh-Hurwitz (Control)

- Equivalency
- Explicit stability condition for opamp circuit parameters

→ Newly derived