

Response of linear systems to periodic inputs

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Let a system have input

$$u(t) = \frac{1}{2} a_0 + \sum_{n=1}^{\infty} A_n \sin(n\omega_0 t + \phi_n) = \sum_{n=-\infty}^{\infty} T_n e^{jn\omega_0 t}$$

The n^{th} real harmonic is $u_n(t) = A_n \sin(n\omega_0 t + \phi_n)$, which yields output

Applying the principle of superposition, the total output is

Similarly, for inputs expressed as complex Fourier Series,

$$y_n(t) = H(jn\omega_0) T_n e^{jn\omega_0 t}$$

and

See the handout **Periodic input response**.

Keep in mind that this is only valid for **linear systems** because superposition doesn't apply to nonlinear systems.