

Control at Bell Labs: Frequency-Domain Methods

The invention of the op amp spurred on further developments in the theory and practice of feedback control:

- ▶ 1932 — [Harry Nyquist](#) studied how sinusoidal signals propagate around the control loop and developed the [Nyquist stability criterion](#)
- ▶ 1934 — [Hendrik Bode](#) studied the relationship between attenuation and phase (leading to the concepts of [phase](#) and [gain margins](#)); identified fundamental limitations of feedback control ([Bode's sensitivity theorem](#)); and developed graphical methods ([Bode plots](#)) for designing feedback controllers ([loop shaping](#))

We will cover this material in the 2nd half of the semester.