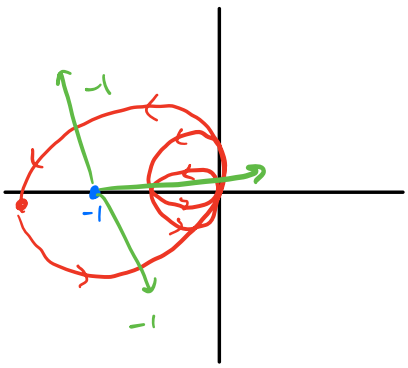
$Z = N + P$

N: net CW encirclements of -1

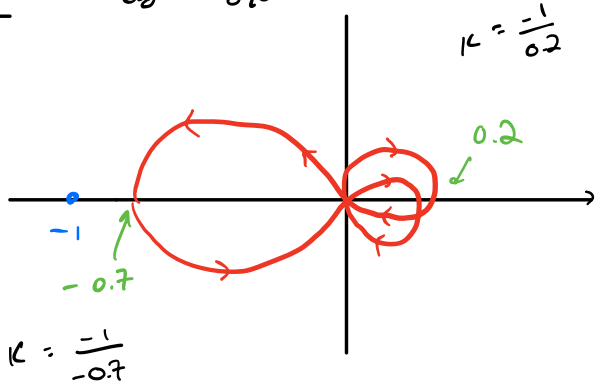
P: # unstable open-loop poles

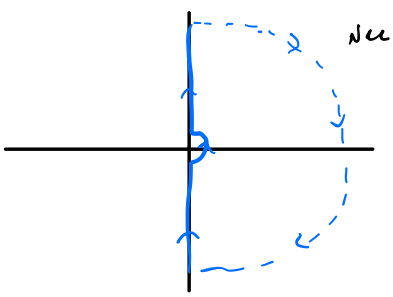
Z: # unstable closed-loop poles



CW: left-to-right crossing

E.g.: Nyquist:





Need to avoid discontinuity in contour

mag still infinite, phase now continuous

$$\angle G(s)\big|_{\omega=-0} - \angle G(s)\big|_{\omega=+0} = -\varphi_{origin}$$

phase only changes for term(pole) at origin

↳ $+180°$ change

n poles @ origin: subtract $n \cdot 180°$ from $-\omega$ to $+\omega$