

Lecture 20

Digital Audio Effects

Echo?

$$y(n) = x(n) + ax(n-D)$$

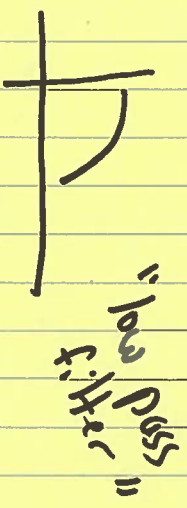
$$Y(z) = X(z) + az^{-D}X(z)$$

$$H(z) = \frac{Y(z)}{X(z)} = 1 + az^{-D}$$

$$H(f) = H(z) \Big|_{z=e^{j2\pi f/k_s}}$$

$$= 1 + a e^{-j2\pi f D/k_s}$$

$$|H(f)| = |1 + a e^{-j2\pi f D/k_s}|$$



①

Flanging:

$$y(n) = x(n) + a(x(n-d(n)))$$

↑
independent

where $d(n)$ is a time-varying delay

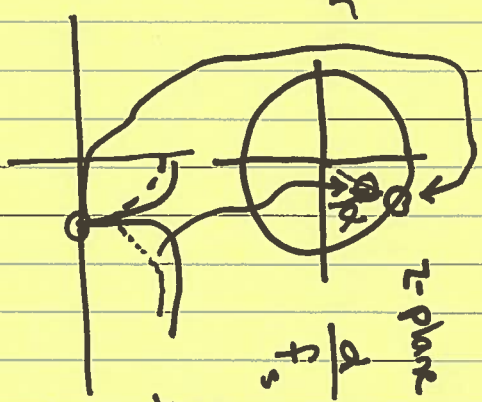
Chorusng:

single sound \rightarrow group of musicians played the sound

$$y(n) = x(n) + a_1 x(n-d_1(n)) + a_2 x(n-d_2(n))$$

Phasing:

Narrow filter



$$\frac{d}{f_s} = 2\pi = 360^\circ$$

moving zero towards the origin broadens the zero