Signal Processing Example - Speech

Periodic (voiced parts)

Harmonic Amplitudes make distinguishable sounds.

Global Pulse

Output

Frequency Domain

Throat LTI (h)

Glotal Pulse

ok because this can be modeled as
Lump this into throat response

Harmonic Amplitudes make distinguishable sounds.

Back to original look at speech signal.
Laplace Transform and Z Transform

We would like to be able to analyze unstable signals and systems. For example, we might want to stabilize a system.

Diff. Equation:

\[ y[n] = x[n] - 5y[n-1] + 3y[n-2] \]

Impulse Response:

\[
\begin{align*}
    y[-1] & = 0, \quad \forall n < 0 \\
    y[0] & = x[0] = 1 \\
    y[1] & = -5 \\
    y[2] & = 28 \\
    y[3] & = -155
\end{align*}
\]

Laplace Transform:

\[ L[x(t)] = \int_{-\infty}^{\infty} x(t)e^{-st} dt \]

If \( s = j\omega \) (is purely imaginary),

\[ |X(s)| = \text{Im} \|X(s)\|_2 \]
This slice is the Fourier Transform.

Region of Convergence:

s plane

Doesn’t Converge  Converge