Creating FM Modulation

Method 1: Mathematical Theory:

https://www.wikiwand.com/en/Frequency_modulation

$$y(t) = A_c \cos\left(2\pi \int_0^t f(\tau) d\tau\right)$$

$$= A_c \cos\left(2\pi \int_0^t \left[f_c + f_\Delta x_m(\tau)\right] d\tau\right)$$

$$= A_c \cos\left(2\pi f_c t + 2\pi f_\Delta \int_0^t x_m(\tau) d\tau\right)$$

Sine Wave: https://www.mathworks.com/help/simulink/slref/sinewave.html?s_tid=srchtitle

Sum: https://www.mathworks.com/help/simulink/slref/add.html?s_tid=srchtitle

Gain: https://www.mathworks.com/help/simulink/slref/gain.html?s_tid=srchtitle

Integrator: https://www.mathworks.com/help/simulink/slref/integrator.html

Trigonometric Function: https://www.mathworks.com/help/simulink/slref/trigonometricfunction.html

Zero-Order Hold: https://www.mathworks.com/help/simulink/slref/zeroorderhold.html

Method 2: Communications Toolbox

FM Modulator Passband: https://www.mathworks.com/help/comm/ref/fmmodulatorpassband.html

Add Noise to Signal:

Method 1: Band-Limited White Noise: https://www.mathworks.com/help/simulink/slref/bandlimitedwhitenoise.html

Method 2: AWGN Channel: https://www.mathworks.com/help/comm/ref/awgnchannel.html

Listen to Audio on Simulink:

https://www.mathworks.com/help/audio/ref/audiodevicewriter.html

FM Demodulation
Method 1: Phase Locked Loop (PLL) FM Detector:
https://www.wikiwand.com/en/Phase-locked_loop

https://www.electronics-notes.com/articles/radio/modulation/fm-frequency-demodulation-phase-locked-loop-pll-detector-demodulator.php#:~:text=The%20phase%20locked%20loop%2C%20PLL%20is%20a%20very%20useful%20RF,replicate%20the%20reference%20signal%20frequency

Matrix Multiply: Math Operations
Analog Filter Design: https://www.mathworks.com/help/dsp/ref/analogfilterdesign.html
Continuous-Time VCO:
https://www.mathworks.com/help/comm/ref/continuoustimevco.html

Method 2: Communications Toolbox
FM Demodulator Passband:
https://www.mathworks.com/help/comm/ref/fmdemodulatorpassband.html

Carrier-Null effect:
https://www.fmsystems-inc.com/manuals/BESSELart.pdf

Q&A:
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