Lecture 4 Sampling & Aliasing Part 1

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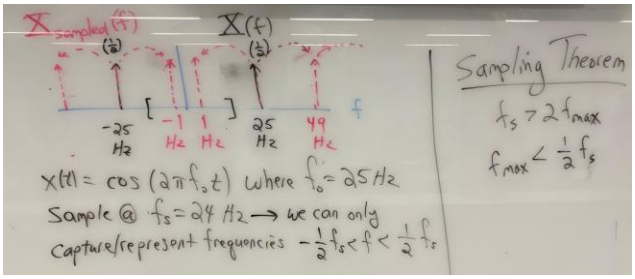
Notes by Jenna May

Demo - video of helicopter taking off. Link to video.

- Camera frame rate matches blade frequency
- Aliases and blades appear still in video
- Effect on camera only, would still appear correctly in person

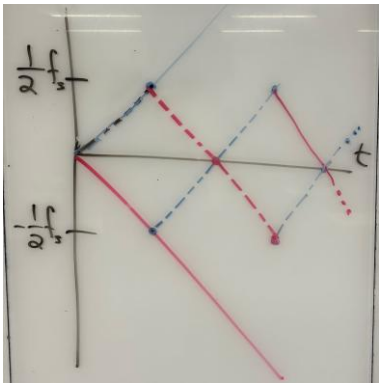
Demo - video of water coming out of a hose. Link to video.

- Camera frame rate fixed at 24 Hz. This is the sampling rate. See HW #0.3.
- Water hose oscillates at the same same frequency as subwoofer audio frequency
- Without subwoofer on, water appears the flow normally out of the hose
- Calibration: subwoofer frequency is adjusted to match the camera frame rate of 24 Hz
- Audio changed to 25Hz tone which will alias due to the camera's frame rate to 1Hz
    - Positive sign of frequency matters: +1 Hz means water flows downward
- Hand movement not aliased because it is moving at a frequency of about 1Hz
- Audio changed to 23Hz tone, which will alias due to the camera's frame rate to -1Hz
    - Negative sign on the aliased frequency value, so water appears to flow up



Spectrogram

- Chirp signal of increasing frequency in spectrogram sampled at fixed sampling rate fs
- Spectrogram plots instantaneous frequency vs. time
- Once the instantaneous frequency exceeds ½ fs, aliasing will occur
    - Solid blue line is pos. freq. component of chirp; dashed blue line due to sampling
    - Solid red line is neg. freq. component of chirp; dashed red line due to sampling



Demo: rotating wheel with arrow painted on the wheel. Link to video.

- Starts to increase in angular frequency, then appears to move quickly rotating in the opposite direction, then slows down rotating in the opposite direction, then stops, then increases rotation speed in the forward direction, etc. This repeats.
- Matches the blue lines in spectrogram diagram above