

# EE2800: Digital Signal Processing

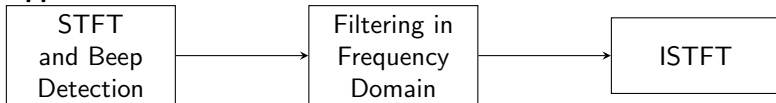
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# Part I - Denoising Beeps

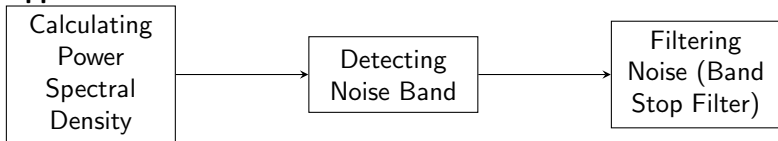
## 1. Approach:



- Design Considerations:** No assumptions were made regarding the speaker. Hamming Window - to make ISTFT easier and negate edge effects. The STFT matrix is analysed to remove beeps and filtered without looking into the future by analysing only the present and the past few segments' FFTs. An adaptive notch filter (non-ideal to negate edge effects) is used and ISTFT is taken at the end.
- Limitations:** Can not detect speech in the same frequency as a noise tone during the active tone, because the fluctuations in the STFT vary - even when no speech is present - making subtraction useless. Thus, although the signal is additively corrupted, the noise is removed via filtering. As it looks at the past 0.5 seconds to determine whether a sound is sustained enough to be a noise, it might not detect a noise for up to 0.5 seconds when live processing takes place - decreasing this time reduces the quality of noise detection and may corrupt the actual speaker.

## Part II - Denoising unknown bands

### 1. **Approach:**



2. **Design Considerations:** Taking a segment of signal samples, a noise band can be detected easily - but this band is not stable for all the segments. Thus, the average of PSD is taken to understand the position of the noise band. The frequency band is detected using the following properties:
- 2.1 The PSD across the noise band is almost constant across time.
  - 2.2 The Magnitude of the noise band is high enough.
3. **Limitations:** Speech in the frequency band of noise may be distorted or removed.