HW 8 ECE 425

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The main output of the program is the resulting signal due to the operations from convolution and the cross correlation with the convolved signal and the generated noise signal. This resulting signal demonstrates the resulting multipath of the original signal. The used for convolution contained five different peaks that correspond to the different peaks in the multipath. Due to the convolution, the signal used for convolution is reversed before being applied to the original voice signal. This explains why the smallest path occurs first due to the smallest magnitude being last in the convolution signal. The convolution signal can also be used to estimate the time between paths due to the number of zeros between each magnitude being defined within the signal.

|  |  |  |  |
| --- | --- | --- | --- |
| Delta Time 1 | Delta Time 2 | Delta Time 3 | Delta Time 4 |
| 0.3084 s | 0.1451 s | 0.2721 | 0.1995 |

Table 1 (Time Value)

These times correspond with the paths from left to right with the first multipath occurring at around one second. So the echos heard in the MATLAB program can be estimated to increase in magnitude and occur approximately at the above time separations. After convolution, the new signal is now approximately double the original signal, as both signals being convolved were the signal. The cross correlation then produces the output shown by comparing the noisy convoluted signal with the original waveform. The cross correlation will check for the similarities between the two and return corresponding peaks according to the sweeping function of the cross correlation. So the peaks occur where the multipath was convolved with the original waveform due to the similarities existing at those points. Since the cross correlation operates rather similarly to the convolution, the signal has approximately doubled again, which explains why the time length in the final plot is approximately four seconds, compared to the original one second recording. The cross correlation max amplitude also corresponds to the max multipath magnitude as this had the strongest return value for the signals. The only other aspect to the signal is the noise that contributes to the sound that can be heard to audibly distort the signal, and stay approximately around the specified magnitudes. Otherwise, the output result seems to make mathematical sense according to the signal processing.

