Second Homework Assignment

of Sound Analysis, Synthesis and Processing

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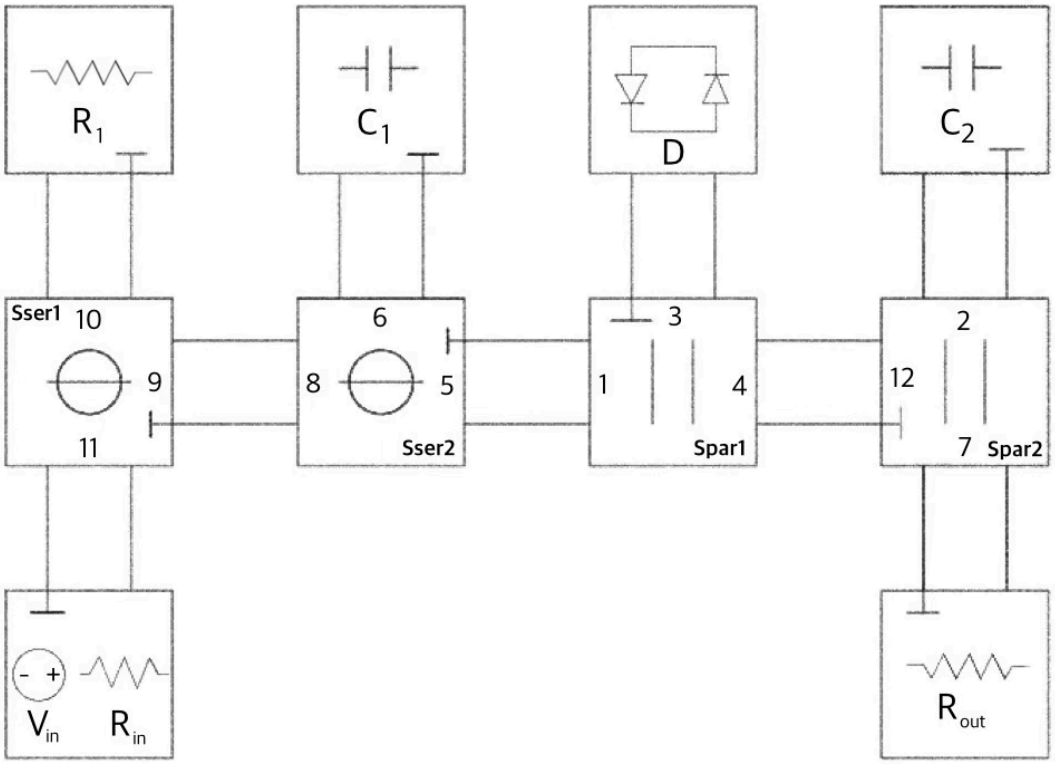
General Description:

The aim of this homework is to implement a Wave Digital Filter on Matlab. In the specific case, the WDF model of the equivalent circuit of the MXR Distortion+ guitar pedal.

WDF Scheme:

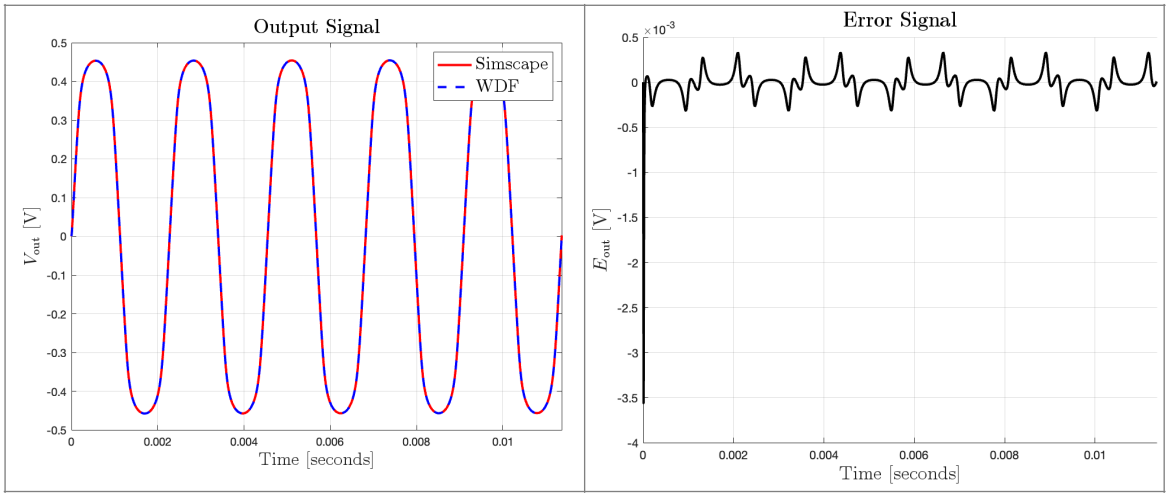


Free Parameters

- Capacitor C_2: $Z_2 = \frac{T_s}{2C_2}$
- Capacitor C_1: $Z_6 = \frac{T_s}{2C_1}$
- Resistance R_1: $Z_{10} = R_1$
- Resistance R_{Out}: $Z_7 = R_{Out}$
- Resistance R_{11}: $Z_{11} = R_{in}$

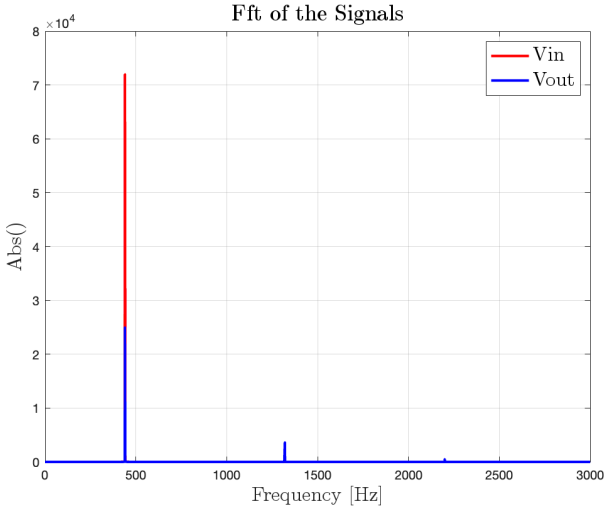
- Parallel junction 1: $Z_3 = \dfrac{Z_1 Z_4}{Z_1 + Z_4}$
- Parallel junction 2: $[Z_4 =]\, Z_{12} = \dfrac{Z_2 Z_7}{Z_2 + Z_7}$
- Series junction 1: $[Z_8 =]\, Z_9 = Z_{10} + Z_{11}$
- Series junction 2: $[Z_1 =]\, Z_5 = Z_6 + Z_8$

Discussion of the results:



As we can notice, the WDF waveform perfectly match the Simscape's one.

The mean square error is equal to $MSE = 2.0941 \cdot 10^{-07}$. In order to see if the algorithm worked well, we plotted also the fft of both the input and the output sinusoid whose module is reported on the right.



It can be noticed that the output signals presents not only a spike in correspondence of the fundamental frequency but also two harmonics due to the distortion generated by the pedal.