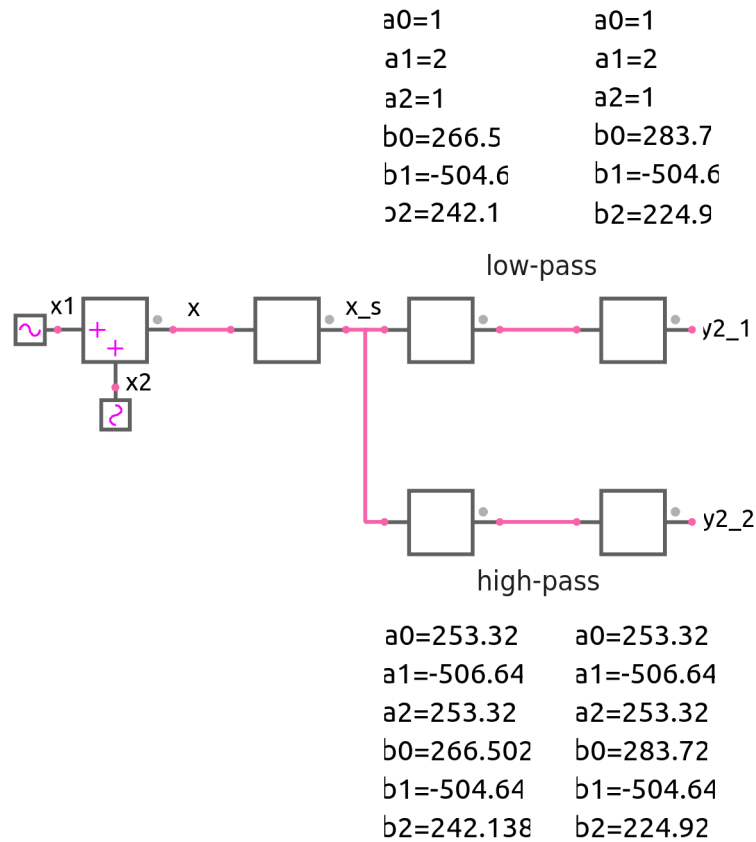


# butterworth\_4\_digital\_trns.sqproj



Shown in the figure are 4<sup>th</sup>-order low-pass and 4<sup>th</sup>-order high-pass digital Butterworth filters.

The filters are designed for a cut-off frequency of 200 Hz.

(See `butterworth_4_digital_ac.tex` for further details regarding  $H(z)$ .)

In this exercise, we want to understand the operation of the filters in the time domain.

## Exercise Set

1. Run the simulation. Plot the input to the filters ( $x$ ), and the outputs of the low-pass and high-pass sections ( $y_{2\_1}$  and  $y_{2\_2}$ , respectively) versus time. Verify the low-pass and high-pass functionality.
2. The filter coefficients have been designed for a sampling rate of 0.1 msec. What will happen if the actual sampling rate is different, say, 0.2 msec or 0.05 msec?

## References

1. A.V. Oppenheim, R.W. Schaffer, and J.R. Buck, *Discrete-time Signal Processing*, Pearson/Prentice-Hall, 1999.