

IIR filter implementations

Purpose

The purpose of this experiment is to implement an IIR filter in real time and to work with an open ended problem.

Background

The first part of this experiment is similar to experiment 3, except that the filter is IIR instead of FIR. The difference equation for an IIR filter is shown below,

$$y[n] = b_0 x[n] + b_1 x[n-1] + \dots + b_{P-1} x[n-P+1] - a_1 y[n-1] - \dots - a_{M-1} y[n-M+1].$$

It is similar to the difference equation for an FIR filter, so the C program written in experiment 3 can be used for IIR filters with minor modifications.

The second part of the experiment is an open ended problem. Open ended problems are problems with no set solution. Use the supplied wave file. It is a recording of people speaking with background noise. You will design a filter (it may be FIR or IIR) so that it sounds better. This is real design! In 5309 you calculated coefficients for given specifications, but here you must select the specifications yourself. As mentioned above, there is no one 'best' solution, and you may have to go through many iterations to find one that works well. As is generally the case, you will want to do much or most of the design using MATLAB, then implement it on the DSK.

Experiments

Experiment 2.1

Design a minimum order IIR filter for the magnitude specifications given in *Figure 2.1* using Matlab. **Use** `iir6bp.asm` to implement this filter. Verify that the system is not linear phase. **Show** that the filter you implement on the DSK meets the specifications. **Answer** the following question. How does the implementation on the DSK compare with the magnitude and phase predicted by MATLAB?

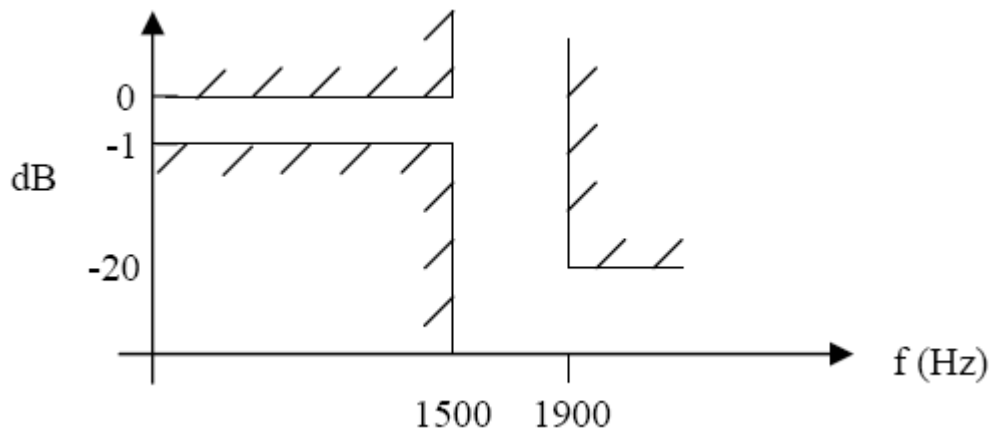


Figure 2.1. Magnitude specifications for lowpass filter.

Experiment 2.2

Modify loopc.c to implement an IIR filter that meets the same specifications as in experiment 2.1.

Show that the filter you implement on the DSK meets the specifications.

Experiment 2.3

Design a filter (FIR or IIR) to make the given wave file sound better.