

# Digital Signal Processing - Lab 5

## Frame based signal processing

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**Note** Before realizing this lab, you should take a moment to read through Chapters 5 and 6 of the course textbook. This lab makes use of advanced features of the OMAP-L138 development board such as the EDMA3 controller, which is explained in the text book.

**Assignment 1** The first assignment is designed to help you become familiar with DMA based projects. The goal of this project is to retrieve the input samples, compute their FFT, compute their inverse FFT and finally output the samples. This is a simple pass-through filter but with added FFT operations.

Create a new Code Composer Studio project and import all the files stored in the folder `C:\DSP\FFT_DMA_Demo`. First read through the code in files `main.c` and `isr.c`. All the processing is done in the `isr.c` file. Try to understand the code. This project already implements an FFT (in `fft.h`). The FFT needs some twiddle forward and backward factors that are already pre-computed for you in the `isr.c` file (see textbook for more details). In the `process_buffer` function, retrieve the left and right samples, copy them into complex buffers, compute their forward and backward fft and return the samples. **Don't forget to scale down the backward FFT.**

**Assignment 2** Create a new EDMA based project. Implement an *overlap-add* algorithm (see textbook) using the DMA controller. Try your convolution with various FIR filters. You can use the Matlab tool `fdatool` to design any filter easily.

**Assignment 3** Improve your *overlap-add* convolution by using the Fast Fourier Transform (FFT) algorithm. In the frequency domain, you can replace the convolution operation by a simple sample-wise multiplication (details in textbook). Again, test your convolution with various filters designed in Matlab. Compare the results with the simple convolution designed in Assignment 2.