*Blind Source Separation Using ICA*

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*Abstract*— This lab allowed us to deepen our knowledge of microprocessors by taking everything we learned from previous labs to implementing a source separation using the Fast Independent Component Analysis (ICA) technique. This experiment contains two parts: first, generating two sine waves, mixing the signals, store and read from flash and outputting mixed signals onto the oscilloscope; second, using FastICA to separate the signals, and outputting the separate signals onto the oscilloscope. The tools used were a microprocessor, namely the STM32 kit, a breadboard, an oscilloscope and coded in Embedded-C using the Keil μVision5 IDE. Additionally, we used the CMSIS-DSP library functions (arm\_sin\_f32()) to generate samples of the sine waves, the HAL drivers to control the on-chip Digital to Analog Converter (DAC), and the Quad-SPI interface for storing samples onto the flash memory.

Keywords—microprocessor, STM32, FastICA, CMSIS-DSP, Quad-SPI

# Introduction

The purpose of this experiment was given to exercise the skills acquired from previous labs to finally building an audio application that employs Blind Source Separation (BSS) using the Fast Independent Component Analysis (FastICA) algorithm. There are many software and hardware limitations such as stm32 flash can only take 8 bits of information at a time or writing an algorithm to the DAC chip might be overwhelming. However, these limitations allow students to turn to strategies such as using the DMA, OS threads, interrupts and CMSIS-DSP library. Students were given the opportunity to explore the several effective functions they can use to minimize runtime, lines of code, to building a creative audio application. In order to initiate the project, a base code was provided for the Keil μVision5 IDE to guide the students on where to implement appropriate codes. However, the base code wasn’t enough to incorporate the QSPI (flash interface), as a result, the software CubeMX was used to modify the base code in order to use QSPI. Moreover, another tool that was provided was the STM32 kit with an audio jack converter. An oscilloscope was also used to display the sine waves. Students were given 2 weeks to deliver the initial demo and 2 weeks to deliver the final demo.

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