

# Introductory Exercise

## Learning to Use the TMS320C54x Software and Hardware Tools

ENEE 429w, Fall 1999

The Indoor Wireless Project has two types of DSP boards for doing the baseband signal processing:

1. the Texas Instruments TMS320C54x Evaluation Module (EVM) which has a 40 MIPS TMS320C541 DSP. This board has a monaural TI TLC320AC01 analog interface chip (AIC) for A/D and D/A conversion with a 19.2 kHz maximum sampling rate and is connected to Serial Port 1.
2. the DSP Research TIGER 549/PC which has a 100 MIPS TMS320C549 DSP. This board has a CRYSTAL CS4216 stereo codec with a maximum sampling rate of 50 kHz. The codec can be connected to Buffered Serial Port 0 or the TDM serial port.

To learn how to use the C54x hardware and software tools, perform the simple exercise of generating a sine wave and observing it on the oscilloscope. You should complete this introductory exercise in two weeks or less. C programs you can use as starting points showing how to initialize the DSP's and codecs can be found on the UNIX system in `/software/boolean/c541util` and `c549util`. In your program, set the codec sampling rate to 8 kHz. Use the C library function `sin()` to generate samples of a 2 kHz sine wave and send these samples to the D/A converter of the codec. That is, generate the sequence

$$s[n] = \sin(2\pi 2000n/8000) = \sin(n\pi/2)$$

You will have to scale the samples appropriately and convert them to integers since the sine samples have magnitudes limited by 1. Keep the following in mind:

- The D/A converter in the EVM AIC is a 14-bit converter. However these 14 bits should be put in the upper 14 bits of the integer sent to the AIC and the least significant two bits should normally be 0.
- The D/A converter on the Tiger board uses 16-bit words.

To get some practice using the systems, send the sine wave samples to the D/A converters two different ways.

1. First use polling of the XRDY flag. That is, monitor the Transmit Ready Flag of the serial port and load a sample into the Data Transmit Register (DXR) when the flag goes high. The flag gets cleared by the load operation and is set when the codec reads a word from the serial port.
2. Next send samples to the codec on serial port interrupts. When the XRDY flag goes high, the serial port sends an interrupt request to the C54x CPU. Then, if this interrupt is enabled, your interrupt service routine should send a sample to the codec. Interrupt routines should be generally kept as short as possible with extensive computations performed outside this routine.