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LibAXDSP (AX8052 DSP Library) Software Manual

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APPLICATION NOTE

Introduction

LibAXDSP is a library providing optimized digital signal processing functions. It contains the following features:

- Finite Impulse Response Filters (signed $16 \times 16 \rightarrow 32$)
- CORDIC (16 bit)

LibAXDSP is available in source and binary form for SDCC, Keil C51 and IAR ICC.

Evaluation Board Peripherals

LIBAXDSP.H

libaxdsp.h contains the Digital Signal Processing routines.

- VOID CORDIC16_VEC*N*(STRUCT CORDIC16 *C)

This function computes the first *N* stages of a 16 bit angular CORDIC algorithm in vectoring mode. The structure pointed to by c contains both the input and output values. It computes:

$$x_{out} \leftarrow k_N \cdot \sqrt{x_{in}^2 + y_{in}^2}$$

$$y_{out} \leftarrow \approx 0$$

$$P_{out} \leftarrow P_{in} + \frac{2^{15}}{\pi} \cdot \arctan\left(\frac{y_{in}}{x_{in}}\right)$$

The most accurate result is obtained with *N* = 15. Lower *N* result in faster but less accurate computation. The scaling constant k_N depends on the number of stages (see table):

N	k_N	N	k_N	N	k_N
		6	1.64669325427364	11	1.64676019268469
2	1.62980060130066	7	1.64674350659690	12	1.64676024176197
3	1.64248406575224	8	1.64675607020488	13	1.64676025403129
4	1.64568891575725	9	1.64675921113982	14	1.64676025709862
5	1.64649227871248	10	1.64675999637562	15	1.64676025786545

- VOID CORDIC16_ROT*N*(STRUCT CORDIC16 *C)

This function computes the first *N* stages of a 16 bit angular CORDIC algorithm in rotation mode. The structure pointed to by c contains both the input and output values. It computes:

$$x_{out} \leftarrow k_N \cdot \left[x_{in} \cdot \cos\left(\frac{P_{in} \cdot \pi}{2^{15}}\right) - y_{in} \cdot \sin\left(\frac{P_{in} \cdot \pi}{2^{15}}\right) \right]$$

$$y_{out} \leftarrow k_N \cdot \left[x_{in} \cdot \sin\left(\frac{P_{in} \cdot \pi}{2^{15}}\right) + y_{in} \cdot \cos\left(\frac{P_{in} \cdot \pi}{2^{15}}\right) \right]$$

$$P_{out} \leftarrow \approx 0$$

The most accurate result is obtained with $N = 15$. Lower N result in faster but less accurate computation. The scaling constant k_N depends on the number of stages (see table):

N	k_N	N	k_N	N	k_N
		6	1.64669325427364	11	1.64676019268469
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4	1.64568891575725	9	1.64675921113982	14	1.64676025709862
5	1.64649227871248	10	1.64675999637562	15	1.64676025786545

- INT32_T FIR_XI16_XI16(CONST INT16_T __XDATA *P0, CONST INT16_T __XDATA *P1, UINT16_T LEN)
  INT32_T FIR_XI16_CI16(CONST INT16_T __XDATA *P0, CONST INT16_T __CODE *P1, UINT16_T LEN)

These functions compute a signed $16 \times 16 \rightarrow 32$ bit finite impulse response filter.

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