

M4 DSP Fast math function

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	本范例代码使用M4内核DSP计算正弦和余弦
BSP 版本	M480 Series BSP CMSIS V3.04.000
开发平台	NuMaker-PFM-M487 Ver 3.0

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1 功能介绍

1.1 简介

展示使用 CMSIS DSP 函式库快速数学运算，其中为三角函数运算包含

1. 正弦(输入为弧度)
2. 余弦(输入为弧度)
3. 正弦和余弦(输入为角度)

用户可以直接使用这些函式，来实现自己的数学方程式运算。

程序内比较了有无使用DSP计算时间的差异，并计算效率提升比率。

1.2 原理

CMSIS DSP函式库，提供了计算正弦，余弦的功能，以查表的方式减少计算时间：

arm_cos_f32(float32_t x)		
参数:	x	[in]欲计算的弧度
回传值:	cos(x)	

arm_sin_f32(float32_t x)		
参数:	x	[in]欲计算的弧度
回传值:	sin(x)	

arm_sin_cos_f32(float32_t theta, float32_t *pSinVal, float32_t *pCosVal)		
参数:	theta	[in] 欲计算的角度
	*pSinVal	[out] sine值输出
	*pCosVal	[out] cosine值输出
回传值:	无	

1.3 执行结果

执行后会打印出以下信息

```
+-----+
| DSP Fast math functions Sample Code |
+-----+

Calculating time with DSP instruction is 0.045583 ms
Calculating time without DSP instruction is 2.823167 ms
Efficiency increase rate is 61.93
```

2 代码介绍

使用CMSIS DSP函数库进行正弦余弦运算：

```
/* Use DSP instruction to calculate sine and cosine with 32 sample */
for(i=0; i< blockSize; i++) {
    /* input is radian */
    cosOutput[i] = arm_cos_f32(testInput_f32[i]);
    sinOutput[i] = arm_sin_f32(testInput_f32[i]);

    /* input is degree */
    arm_sin_cos_f32(testInput_f32[i], &sinOutput1[i], &cosOutput1[i]);
}
```

接着使用CPU进行相同的计算：

```
/* Calculate sine and cosine with 32 sample */
for(i=0; i< blockSize; i++) {
    /* input is radian */
    cosine[i] = cos(testInput_f32[i]);
    sine[i] = sin(testInput_f32[i]);
    /* input is radian */
    sin_cos(testInput_f32[i]);
}
```

把计数器换成时间，其中计数器时钟源为HXT 12MHz：

```
/* Calculate the time, timer clock source is 12M, unit is ms */
DSPCalTime = (DSPCalTime/12000000) * 1000;
CalTime = (CalTime/12000000)* 1000;
```

3 软件与硬件环境

- 软件环境

- BSP 版本

- ◆ M480 Series BSP CMSIS V3.04.000

- IDE 版本

- ◆ Keil uVersion 5.26

- 硬件环境

- 电路组件

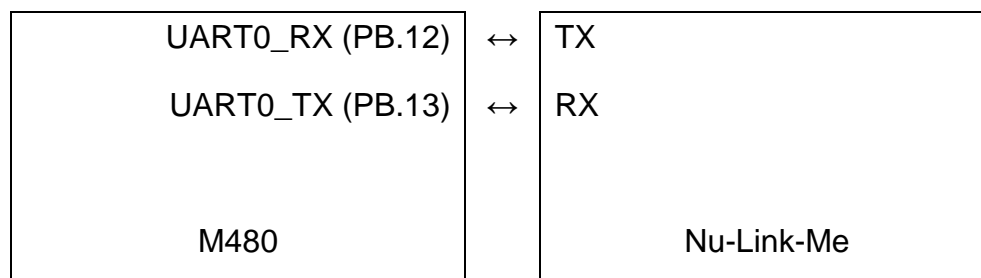
- ◆ NuMaker-PFM-M487 or other M480 Development Board

- 示意图

M480 的 UART0_RX(PB.12)、UART0_TX(PB.13)连接至 Nu-Link Me，打印讯息。







设置终端机的 COM Port 与 Baud，COM Port 的编号可在设备管理器中找到「NuBridge

Virtual Com Port (COMX)」，Baud 设置为 115200。



4 目录信息

EC_M480_DSP_FastMath_V1.00

 Library	Sample code header and source files
 CMSIS	Cortex [®] Microcontroller Software Interface Standard (CMSIS) by Arm [®] Corp.
 Device	CMSIS compliant device header file
 StdDriver	All peripheral driver header and source files
 SampleCode	
 ExampleCode	Source file of example code

5 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 DSP_FastMath.uvproj
2. 进入编译模式接口
 - a. 编译
 - b. 下载代码至内存
 - c. 进入 / 离开除错模式
3. 进入除错模式接口
 - a. 执行代码

6 修订纪录

Date	Revision	Description
Jun. 25, 2019	1.00	1. 初始发布.

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