TEST Special Stats Module with ceedling (CL2 boards)

This DOC in C:\cvavr328\Work3\CL2\CL2_Modules\Stats_Special\DOC

14.10.2018 / document revised 05.2022

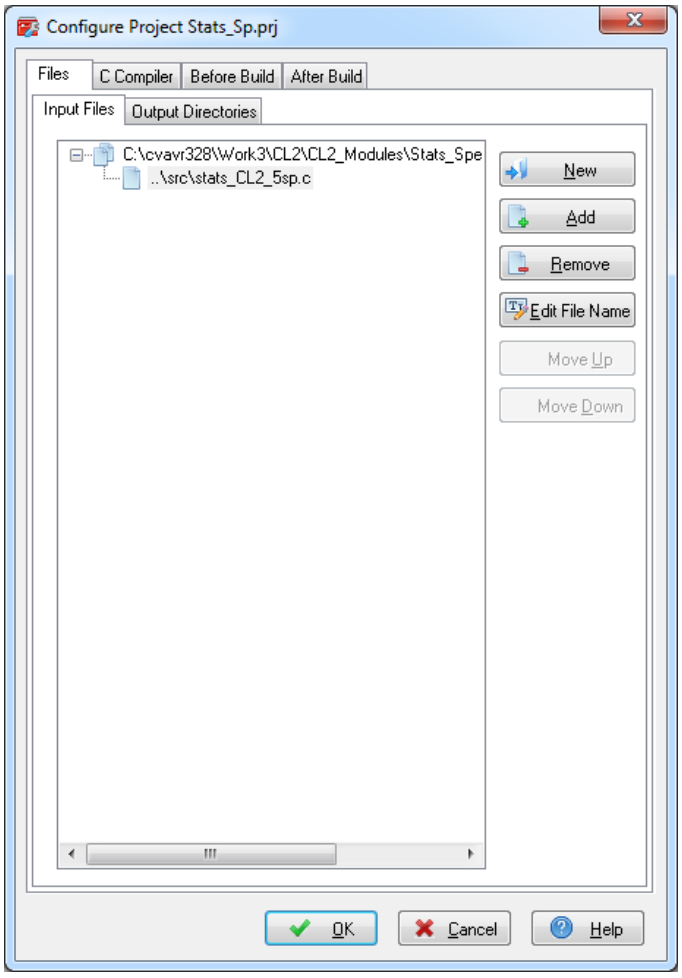
This document explains the procedure used for testing one of the sections the /stats module in /modules/stats of the PWRC2 application running on CL2 boards, now in its version 10a. The specific section computes vector averages of wind direction based on METEO board wind-vane measurements, transmitted via RS485 to the CL2 main CPU boards. These modules are originally compiled in CVAVR Codevision IDE for AVR. Most higher level modules can be tested using Ceedling running on Linux in a separate virtual machine because they are not dependant on hardware details.

Procedure as used in testing of SpecialStats submodule:

1. Extract from StatsCL2-5VN.c/.h only the special Stats section

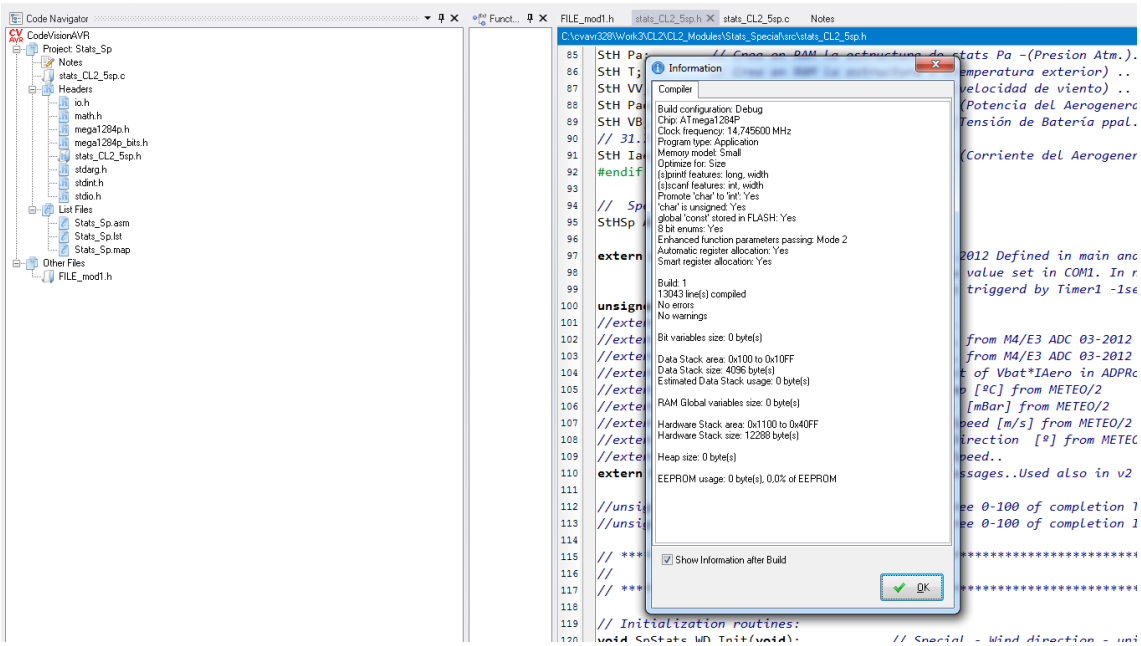
2. Save in C:\cvavr328\Work3\CL2\CL2_Modules\Stats_Special\src\stats_CL2_5sp.c / .h

3. In CVAVr328, make a Test Project to compile it, prune the .h file



Add stdio.h, stdint.h to .h file.

4) We prune until compiles correctly



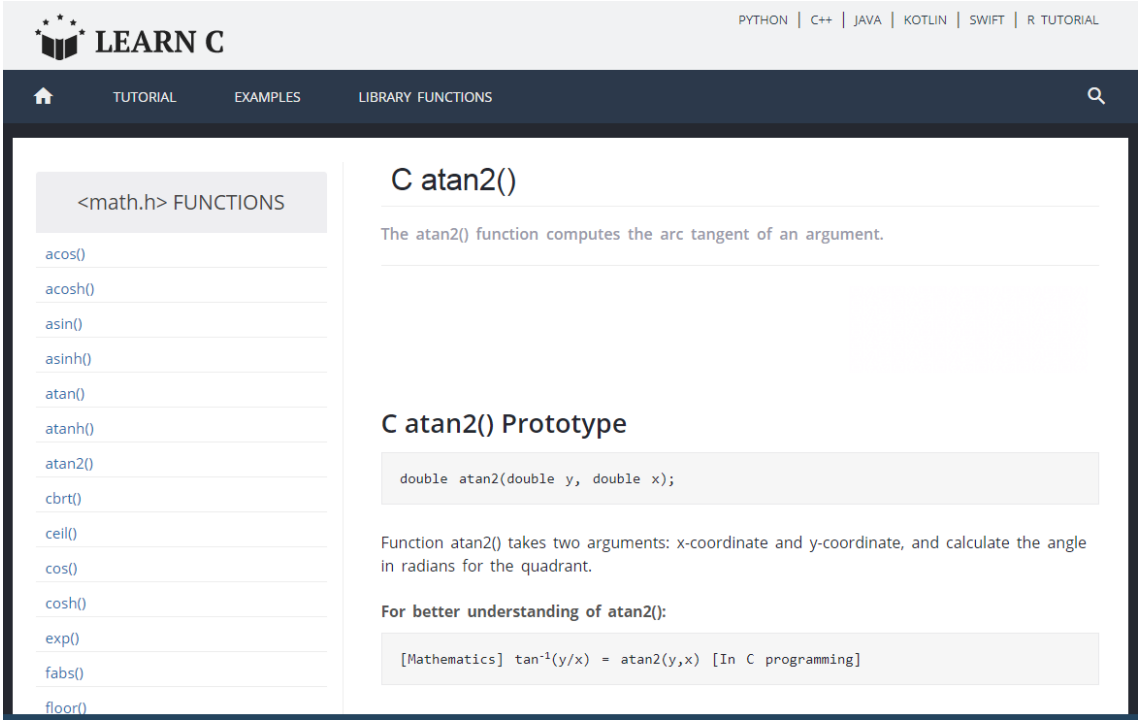
14.10.2018 Copy to CEEDLING TESTs under Ubuntu

Checking Values in Excel:

The computation function in C is atan2(y,x) = artg(y/x), whereas the same is

atan2(x,y) in Excel. 

- To be noted on Tests..



a) For fixed value at Samp = 120º

TESTING DE SOFTWARE CESE2018 R.OLIVA (Case: values fixed at 120 deg)
PRUEBA DE SpStats_WD() 10.2018

Av_vx	Av_vy	(iniciales)
0	0	

K_PI_OVER180 =	0.017453293
K_180_OVER_PI=	57.29577951

J	SampDeg	SampleRad	Vvx = sin(sampR)		Av_vx	Av_vy	Av_vx_fin	Av_vy_fin		WD_Calc1	WD_Av_Real
2	120.00000	2.09439510	0.86603	-0.50000	0.00000	0.00000	0.43301	-0.25000		120.00000	120.00000
3	120.00000	2.09439510	0.86603	-0.50000	0.43301	-0.25000	0.57735	-0.33333		120.00000	120.00000
4	120.00000	2.09439510	0.86603	-0.50000	0.57735	-0.33333	0.64952	-0.37500		120.00000	120.00000
5	120.00000	2.09439510	0.86603	-0.50000	0.64952	-0.37500	0.69282	-0.40000		120.00000	120.00000
6	120.00000	2.09439510	0.86603	-0.50000	0.69282	-0.40000	0.72169	-0.41667		120.00000	120.00000
7	120.00000	2.09439510	0.86603	-0.50000	0.72169	-0.41667	0.74231	-0.42857		120.00000	120.00000
8	120.00000	2.09439510	0.86603	-0.50000	0.74231	-0.42857	0.75777	-0.43750		120.00000	120.00000
9	120.00000	2.09439510	0.86603	-0.50000	0.75777	-0.43750	0.76980	-0.44444		120.00000	120.00000
10	120.00000	2.09439510	0.86603	-0.50000	0.76980	-0.44444	0.77942	-0.45000		120.00000	120.00000
11	120.00000	2.09439510	0.86603	-0.50000	0.77942	-0.45000	0.78730	-0.45455		120.00000	120.00000
12	120.00000	2.09439510	0.86603	-0.50000	0.78730	-0.45455	0.79386	-0.45833		120.00000	120.00000
13	120.00000	2.09439510	0.86603	-0.50000	0.79386	-0.45833	0.79941	-0.46154		120.00000	120.00000
14	120.00000	2.09439510	0.86603	-0.50000	0.79941	-0.46154	0.80417	-0.46429		120.00000	120.00000

// in math.h (C99) it's float atan2(double y, double x) = arctg(y/x), in Excel the function is : ATAN2(**coord_x**; coord_y)
WD_Calc1 = K_180_OVER_PI*(atan2(Av_vx;Av_vy) '// Av_vx is y comp, Av_vy is x to get reference to 0º= N
WD_Av_Real = if(WD_Av_Real<0) WD_Av_Real+360, else WD_Av_Real

b.)For values close to N:

TESTING DE SOFTWARE CESE2018 R.OLIVA (Case: values close to N, near 0 or 360)
PRUEBA DE SpStats_WD() 10.2018

Av_vx	Av_vy	(iniciales)
0	0	

K_PI_OVER180 =	0.017453293
K_180_OVER_PI=	57.29577951

J	SampDeg	SampleRad	Vvx = sin(sampR)		Av_vx	Av_vy	Av_vx_fin	Av_vy_fin		WD_Calc1	WD_Av_Real
2	0.00000	0.00000000	0.00000	1.00000	0.00000	0.00000	0.00000	0.50000		0.00000	0.00000
3	0.00000	0.00000000	0.00000	1.00000	0.00000	0.50000	0.00000	0.66667		0.00000	0.00000
4	0.00000	0.00000000	0.00000	1.00000	0.00000	0.66667	0.00000	0.75000		0.00000	0.00000
5	5.00000	0.08726646	0.08716	0.99619	0.00000	0.75000	0.01743	0.79924		1.24940	1.24940
6	350.00000	6.10865238	-0.17365	0.98481	0.01743	0.79924	-0.01442	0.83017		-0.99481	359.00519
7	5.00000	0.08726646	0.08716	0.99619	-0.01442	0.83017	0.00009	0.85389		0.00636	0.00636
8	2.00000	0.03490659	0.03490	0.99939	0.00009	0.85389	0.00445	0.87207		0.29206	0.29206
9	357.00000	6.23082543	-0.05234	0.99863	0.00445	0.87207	-0.00186	0.88614		-0.12050	359.87950
10	358.00000	6.24827872	-0.03490	0.99939	-0.00186	0.88614	-0.00517	0.89746		-0.32989	359.67011
11	1.00000	0.01745329	0.01745	0.99985	-0.00517	0.89746	-0.00311	0.90677		-0.19657	359.80343
12	0.00000	0.00000000	0.00000	1.00000	-0.00311	0.90677	-0.00285	0.91454		-0.17866	359.82134
13	359.00000	6.26573201	-0.01745	0.99985	-0.00285	0.91454	-0.00397	0.92110		-0.24725	359.75275
14	0.00000	0.00000000	0.00000	1.00000	-0.00397	0.92110	-0.00369	0.92674		-0.22819	359.77181

// in math.h (C99) it's float atan2(double y, double x) = arctg(y/x), in Excel the function is : ATAN2(**coord_x**; coord_y)
WD_Calc1 = K_180_OVER_PI*(atan2(Av_vx;Av_vy) '// Av_vx is y comp, Av_vy is x to get reference to 0º= N
WD_Av_Real = if(WD_Av_Real<0) WD_Av_Real+360, else WD_Av_Real

NOTES 14.10.18

Test compilation correct, problems on linking with math.h functions. Adding –lm to linker desde Ceedling. First version on Github, Professor E. Volentini makes revision

-> Mail to E.Volentini, 22:50 revision requested.

15.10.2018 CORRECTED with con Defaults.rb (see issue #92 Ceedling github)

TESTING DE SOFTWARE CESE2018 R.OLIVA (Case: values close to N, near 0 or 360, as in sp_stats_test.c)
PRUEBA DE SpStats_WD() 10.2018

Av_vx	Av_vy	(iniciales)
0	0	

K_PI_OVER180 =	0.017453293
K_180_OVER_PI=	57.29577951

J	SampDeg	SampleRad	Vvx = sin(sampR)		Av_vx	Av_vy	Av_vx_fin	Av_vy_fin		WD_Calc1	WD_Av_Real
2	0.00000	0.00000000	0.00000	1.00000	0.00000	0.00000	0.00000	0.50000		0.00000	0.00000
3	0.00000	0.00000000	0.00000	1.00000	0.00000	0.50000	0.00000	0.66667		0.00000	0.00000
4	5.00000	0.08726646	0.08716	0.99619	0.00000	0.66667	0.02179	0.74905		1.66620	1.66620
5	356.00000	6.21337214	-0.06976	0.99756	0.02179	0.74905	0.00348	0.79875		0.24961	0.24961
6	2.00000	0.03490659	0.03490	0.99939	0.00348	0.79875	0.00872	0.83219		0.60010	0.60010
7	0.00000	0.00000000	0.00000	1.00000	0.00872	0.83219	0.00747	0.85616		0.49997	0.49997
8	359.00000	6.26573201	-0.01745	0.99985	0.00747	0.85616	0.00436	0.87412		0.28550	0.28550
9	5.00000	0.08726646	0.08716	0.99619	0.00436	0.87412	0.01356	0.88769		0.87489	0.87489
10	1.00000	0.01745329	0.01745	0.99985	0.01356	0.88769	0.01395	0.89890		0.88881	0.88881
11	358.20000	6.25176938	-0.03141	0.99951	0.01395	0.89890	0.00982	0.90805		0.61973	0.61973

// in math.h (C99) it's float atan2(double y, double x) = arctg(y/x), in Excel the function is : ATAN2(**coord_x**; coord_y)
WD_Calc1 = K_180_OVER_PI*(atan2(Av_vx;Av_vy) '// Av_vx is y comp, Av_vy is x to get reference to 0º= N
WD_Av_Real = if(WD_Av_Real<0) WD_Av_Real+360, else WD_Av_Real

The computed value in tests is 0.619717, good approximation.

Second vector for testing South Directionl S – expected vector average of 188.193º

TESTING DE SOFTWARE CESE2018 R.OLIVA (Case 5: values close to S, near 180deg, as in sp_stats_test.c)
PRUEBA DE SpStats_WD() 10.2018

Av_vx	Av_vy	(iniciales)
0	0	

K_PI_OVER180 =	0.017453293
K_180_OVER_PI=	57.29577951

J	SampDeg	SampleRad	Vvx = sin(sampR)		Av_vx	Av_vy	Av_vx_fin	Av_vy_fin		WD_Calc1	WD_Av_Real
2	190.00000	3.31612558	-0.17365	-0.98481	0.00000	0.00000	-0.08682	-0.49240		-170.00000	190.00000
3	190.00000	3.31612558	-0.17365	-0.98481	-0.08682	-0.49240	-0.11577	-0.65654		-170.00000	190.00000
4	175.00000	3.05432619	0.08716	-0.99619	-0.11577	-0.65654	-0.06504	-0.74145		-174.98723	185.01277
5	180.00000	3.14159265	0.00000	-1.00000	-0.06504	-0.74145	-0.05203	-0.79316		-176.24701	183.75299
6	190.00000	3.31612558	-0.17365	-0.98481	-0.05203	-0.79316	-0.07230	-0.82510		-174.99235	185.00765
7	190.80000	3.33008821	-0.18738	-0.98229	-0.07230	-0.82510	-0.08874	-0.84756		-174.02296	185.97704
8	191.00000	3.33357887	-0.19081	-0.98163	-0.08874	-0.84756	-0.10150	-0.86432		-173.30238	186.69762
9	193.00000	3.36848546	-0.22495	-0.97437	-0.10150	-0.86432	-0.11521	-0.87654		-172.51188	187.48812
10	192.00000	3.35103216	-0.20791	-0.97815	-0.11521	-0.87654	-0.12448	-0.88671		-172.00850	187.99150
11	190.00000	3.31612558	-0.17365	-0.98481	-0.12448	-0.88671	-0.12895	-0.89562		-171.80675	188.19325

// in math.h (C99) it's float atan2(double y, double x) = arctg(y/x), in Excel the function is : ATAN2(**coord_x**; coord_y)
WD_Calc1 = K_180_OVER_PI*(atan2(Av_vx;Av_vy) '// Av_vx is y comp, Av_vy is x to get reference to 0º= N
WD_Av_Real = if(WD_Av_Real<0) WD_Av_Real+360, else WD_Av_Real

Output values found to be correct.

ANNEX I – Test file (test_sp_stats.c) Listing:

```
#include "unity.h"
#include "stats_CL2_5sp.h"

// Vector global para ensayo cerca de WDIR= Norte (0==360°)
// primeros 2 ignorados
float SampleDeg[] ={
          0.0,0.0,
          0.0,0.0,5.0,356.0,2.0,
          0.0,359.0,5.0,1.0,358.2 };

// Vector global para ensayo cerca de WDIR= SUR (180°)
// primeros 2 ignorados
float SampleDeg2[] ={
          0.0,0.0,
          190.0,190.0,175.0,180.0,190.0,
          190.8,191.0,193.0,192.0,190.0};

void setUp(void) {
   Stats_Call_Init();
   AUX.DSampleDeg = 120.0;
   AUX.CSampleRho = 1.1;

}

void tearDown(void) {
}

void test_SpStats_WD(void) {

   SpStats_WD(&j_aver);
   // TEST_ASSERT_FLOAT_WITHIN(delta, expected,actual);
   TEST_ASSERT_FLOAT_WITHIN(0.1, 0.43301, AUX.A_v_vx);
   TEST_ASSERT_FLOAT_WITHIN(0.1, -0.25, AUX.A_v_vy);
   Stats_Find_WDIR_Av();
   TEST_ASSERT_FLOAT_WITHIN(0.1, 120.0, AUX.WD_Av);
}

void test_SpStatsIter_WDN(void) {

       Stats_Call_Init();
   // Leer vector de valores de muestras cerca del N
   do{
          AUX.DSampleDeg = SampleDeg[j_aver];
          SpStats_WD(&j_aver); // Computa promedio vector
       j_aver++;
   } while(j_aver <12);
   Stats_Find_WDIR_Av();
   // TEST_ASSERT_FLOAT_WITHIN(delta, expected,actual);
   TEST_ASSERT_FLOAT_WITHIN(0.1, 0.6, AUX.WD_Av);
}

void test_SpStatsIter_WDS(void) {
   Stats_Call_Init();
   do{
          AUX.DSampleDeg = SampleDeg2[j_aver];
          SpStats_WD(&j_aver);
       j_aver++;
   } while(j_aver <12);
   Stats_Find_WDIR_Av();
   // TEST_ASSERT_FLOAT_WITHIN(delta, expected,actual);
   TEST_ASSERT_FLOAT_WITHIN(0.1, 188.0, AUX.WD_Av);
}
```