Ministry of Communications and Information Technology

egypt fwd initiative

مستقبلنا رقمي

UDACITY

Embedded Systems Advanced Nanodegree Program

Automotive Door Control System Design (Static Design)

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Tasks	Periodicity	Deadline	Execution time	Occurrence in hyperperiod
BUT1	50ms	50ms	12us	2
BUT2	50ms	50ms	13us	2
Periodic Transmitter	100ms	100ms	140us	1
Uart	20ms	20ms	150us	5
Load1	10ms	10ms	5ms	10
Load2	100ms	100ms	12ms	1

- **Hyper period is 100ms**
- **CPU Load :**

Utilization = total execution time/hyper-period

Utilization = (2*(12us) + 2*(13us) + 1*(140u) + 5(150us) + 10(5ms) + 1(12ms))/(100m) = 62.9%

Utilization = 62.9%

- **System Schedulable**
  - **Rate Monotonic**

Utilization"U" = 63.16%

number of tasks"N" = 6

If (U < N(2^(1/N)-1)) then system is schedulable

0.629 < 0.734 thus system is schedulable

○ Time Demand

$$w_i(t) = e_i + \sum_{k=1}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k$$

Worst cases >> 100ms

hyperperiod	Tasks	test	periodicit
10	Load1	W1(10) =5ms+0=5ms	10ms
5	Uart	W2(20)=150us+(20/10)*5ms=10.15ms	20ms
2	BUT1	W3(50)=12us+(50/20)*150us+(50/10)*5=25.38	50ms
2	BUT2	25.4	50ms
1	Periodic Transmitter	51	100ms
1	Load2	63.6	100ms

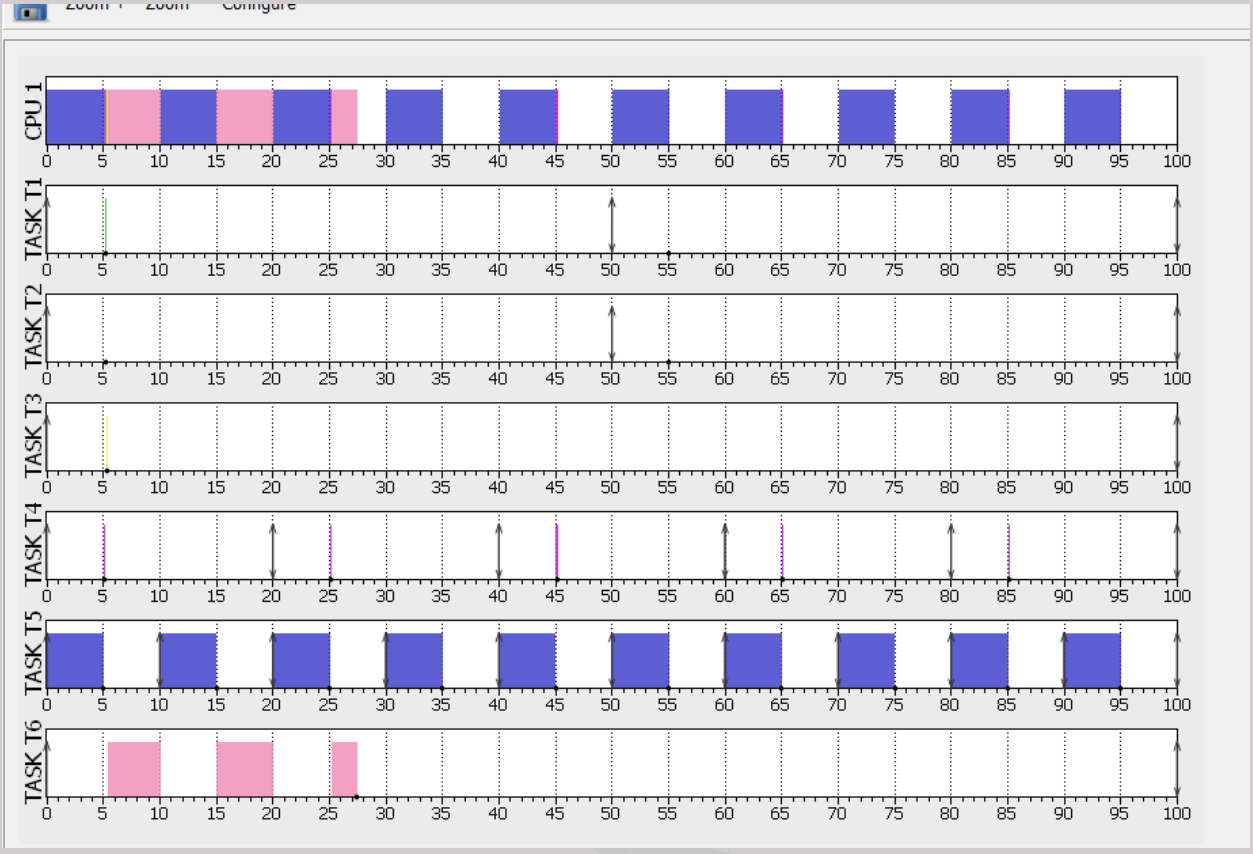
Simso

Model data

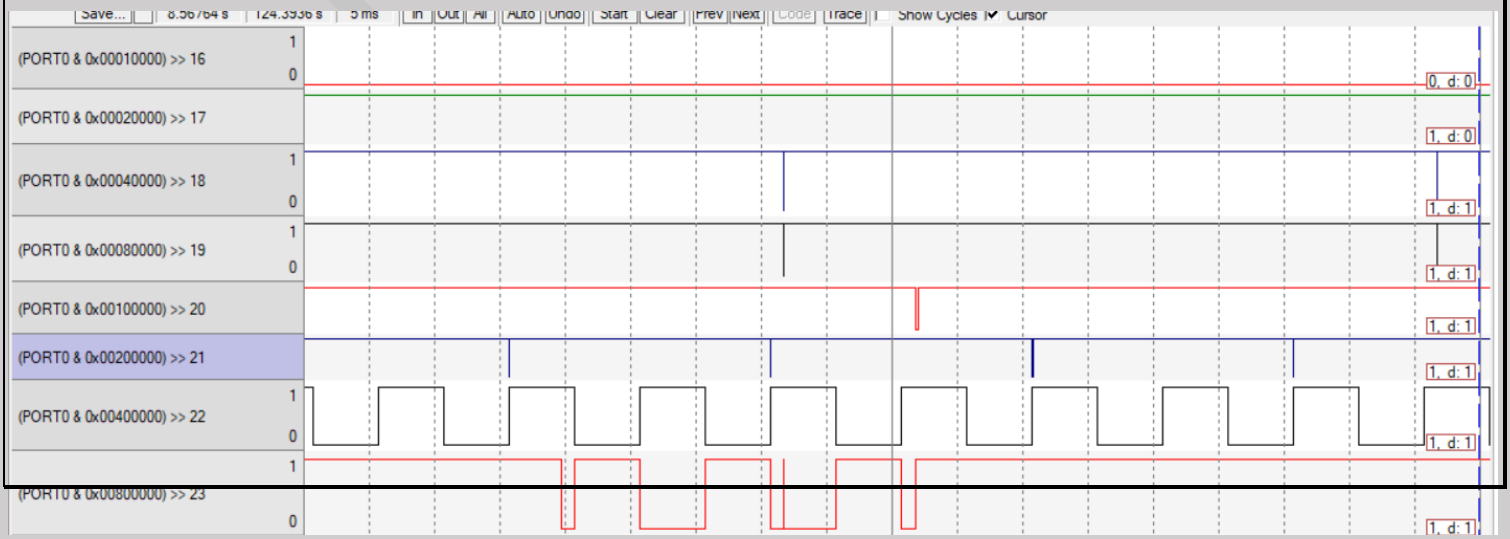
General | Scheduler | Processors | Tasks

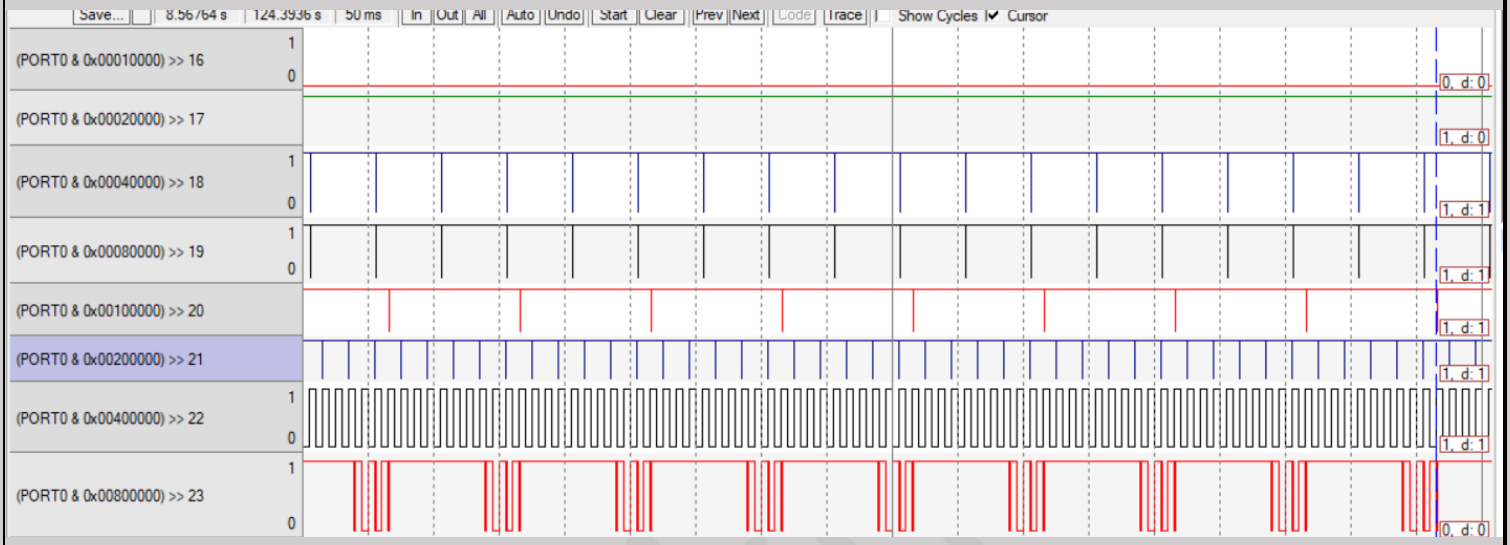
id	Name	Task type	bort on mi	Date (	eriod (ms)	ct. da	dline	WCET (ms)
1	TASK T1	Periodic	No	0	50	-	50	0.012
2	TASK T2	Periodic	No	0	50	-	50	.013
3	TASK T3	Periodic	No	0	100	-	100	.14
4	TASK T4	Periodic	No	0	20	-	20	.15
5	TASK T5	Periodic	No	0	10	-	10	5
6	TASK T6	Periodic	No	0	100	-	100	12

	Total load	Payload	System load
CPU 1	0.6294	0.6294	0.0000
Average	0.6294	0.6294	0.0000



Kiel implementation




Save...
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124.3936 s
50 ms
In
Out
All
Auto
Undo
Start
Clear
Prev
Next
Code
Trace
Show Cycles
Cursor
(PORT0 & 0x00010000) >> 16
(PORT0 & 0x00020000) >> 17
(PORT0 & 0x00040000) >> 18
(PORT0 & 0x00080000) >> 19
(PORT0 & 0x00100000) >> 20
(PORT0 & 0x00200000) >> 21
(PORT0 & 0x00400000) >> 22
(PORT0 & 0x00800000) >> 23
1
0
0, d: 0
1, d: 0
1, d: 1
1, d: 1
1, d: 1
1, d: 1
1, d: 1
0, d: 0