

PROJECT 2: IMPLEMENTING EDF SCHEDULER

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1. Using analytical methods

System HyperPeriod

Task	Periodicity
Button_1_Monitor	50 ms
Button_2_Monitor	50 ms
Periodic_Transmitter	100 ms
Uart_Receiver	20 ms
Load_1_Simulation	10 ms
Load_2_Simulation	100 ms

HyperPeriod = *Least common multiplier*

HyperPeriod = 100 ms

CPU Load

Task	Execution Time (during 1 hyperperiod)
Button_1_Monitor	13*2 us
Button_2_Monitor	13*2 us
Periodic_Transmitter	20*1 us
Uart_Receiver	5*28 us
Load_1_Simulation	5*10 ms
Load_1_Simulation	12*1 ms

Total Execution Time (one hyperperiod) = 26 us + 26 us + 20 us + 140 us +
50 ms + 12 ms = 62.212 ms

$$\text{CPU Load} = \frac{\text{Total Execution Time}}{\text{Total System Time}}$$

$$\text{CPU Load} = \frac{62.212}{100} * 100 = 62.212\%$$

System Schedulability:

Using Time Demand Analysis

Task 1: Load 1 Simulation (E: 5 ms, P: 10ms, Provided Time=10ms)

$$w_1(10) = 5 \text{ ms} + 0 = 5$$

$$w(10) = 5 < 10$$

Task 1: Load 1 simulation is schedulable

Task 2: Uart Receiver (E: 28 us, P: 20 ms, Provided Time=20ms)

$$w_2(20) = 28 \text{ us} + (20/10) * 5 = 10.02$$

$$w(20) = 10.02 < 20$$

Task 2: Uart Receiver is schedulable

Task 3: Button 1 Monitor (E: 13 us, P: 50 ms, Provided Time=50ms)

$$w_3(50) = 13 \text{ us} + (50/10) * 5(\text{ms}) + (50/20) * 28 (\text{us}) = 25.083 \text{ ms}$$

$$w(50) = 25.083 < 50$$

Task 3: Button 1 Monitor is schedulable

Task 4: Button 2 Monitor (E: 13 us, P: 50ms, Provided Time=50ms)

$$w_4(50) = 13 \text{ us} + (50/10) * 5 \text{ ms} + (50/20) 28 \text{ us} + (50/50) 13 \text{ us} = 25.096$$

$$w(50) = 25.096 < 50$$

Task 4: Button 2 Monitor is schedulable

Task 5: Periodic Transmitter (E: 27 us, P: 100 ms, Provided Time=100ms)

$$w_5(100) = 27 \text{ us} + (100/10) * 5 \text{ ms} + (100/20) 28 \text{ us} + (100/50) * 13 \text{ us} + \\ (100/50) * 13 \text{ us} = 50.219 \text{ ms}$$

$$w(100) = 50.219 < 100$$

Task 5 : Periodic Transmitter is schedulable

Task 6: Load 2 Simulation (E: 24 ms, P: 100 ms, Provided Time=100ms)

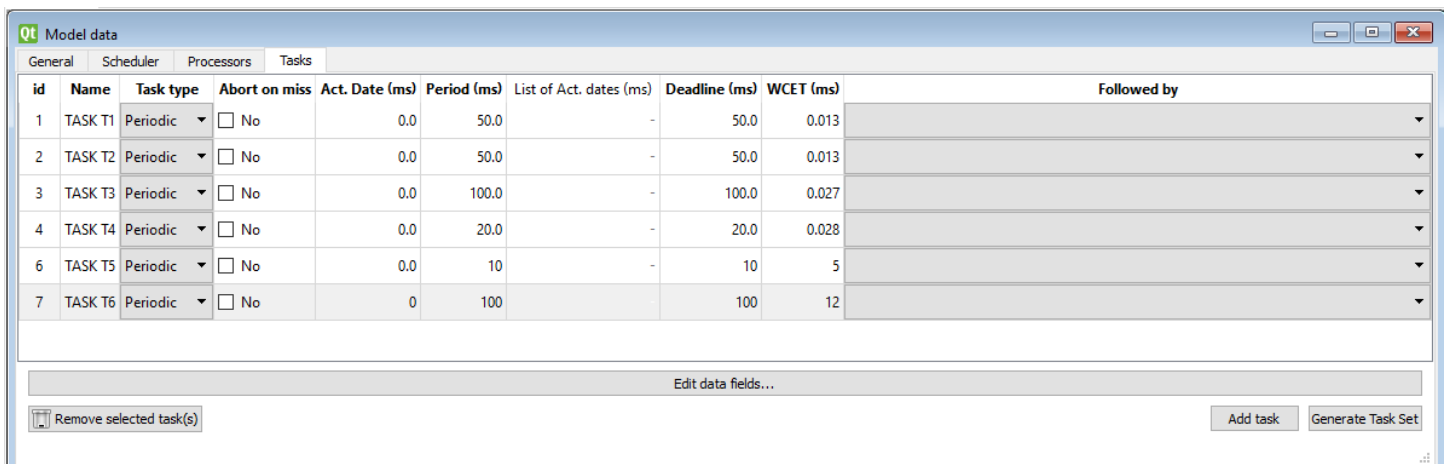
$$w_6(100) = 12 \text{ ms} + (100/10) * 5 \text{ (ms)} + (100/20) * 28 \text{ (us)} + (100/50) * 13 \text{ u} \\ + (100/50) 13 \text{ us} + (100/100) 27 \text{ us} = 62.219$$

$$w(100) = 62.219 < 100$$

Task 6: Load 2 Simulation is schedulable

2. SIMSO simulator

Tasks set:

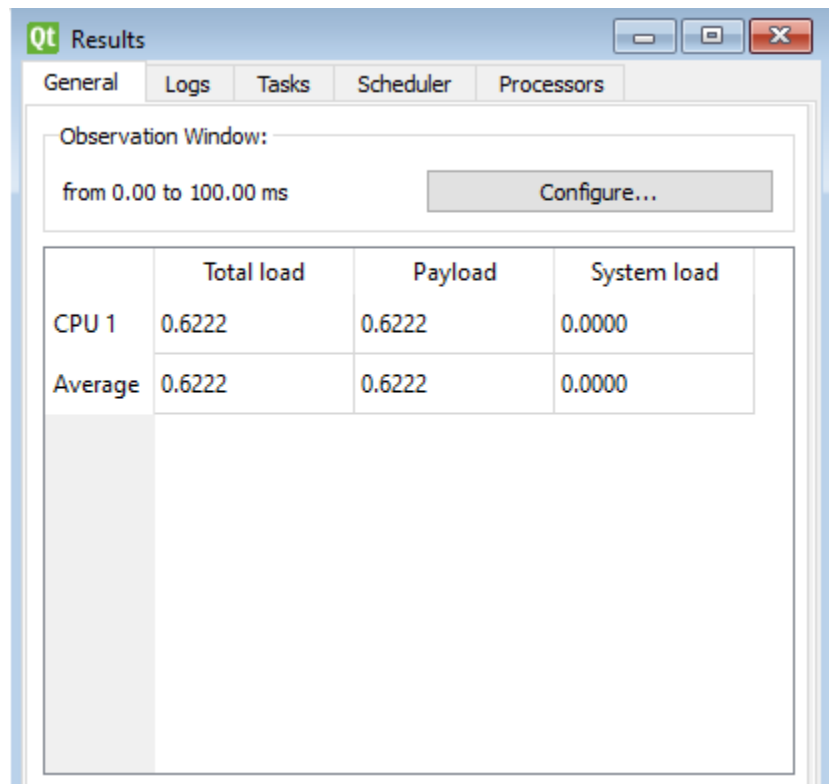


The screenshot shows the 'Qt Model data' window with the 'Tasks' tab selected. It contains a table with 10 columns: id, Name, Task type, Abort on miss, Act. Date (ms), Period (ms), List of Act. dates (ms), Deadline (ms), WCET (ms), and Followed by. There are 7 rows of task data. Below the table is an 'Edit data fields...' button, and at the bottom are 'Remove selected task(s)', 'Add task', and 'Generate Task Set' buttons.

id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	TASK T1	Periodic	<input type="checkbox"/> No	0.0	50.0	-	50.0	0.013	
2	TASK T2	Periodic	<input type="checkbox"/> No	0.0	50.0	-	50.0	0.013	
3	TASK T3	Periodic	<input type="checkbox"/> No	0.0	100.0	-	100.0	0.027	
4	TASK T4	Periodic	<input type="checkbox"/> No	0.0	20.0	-	20.0	0.028	
6	TASK T5	Periodic	<input type="checkbox"/> No	0.0	10	-	10	5	
7	TASK T6	Periodic	<input type="checkbox"/> No	0	100	-	100	12	

Results:

We can see that we have the same CPU load that we have calculated by analytical method.

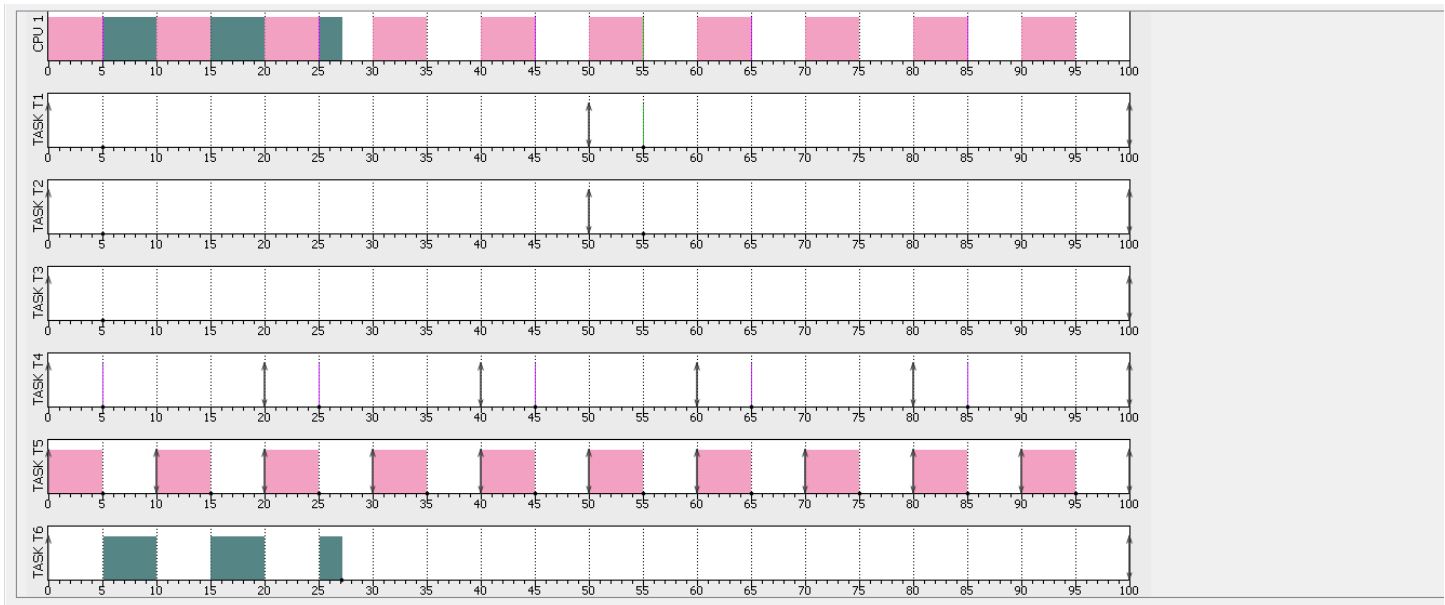


The screenshot shows the 'Qt Results' window with the 'General' tab selected. It features an 'Observation Window' section with a range of 'from 0.00 to 100.00 ms' and a 'Configure...' button. Below this is a table with 4 columns: CPU, Total load, Payload, and System load. The table has two rows: 'CPU 1' and 'Average', both showing a total load of 0.6222, a payload of 0.6222, and a system load of 0.0000.

	Total load	Payload	System load
CPU 1	0.6222	0.6222	0.0000
Average	0.6222	0.6222	0.0000

Timeline:

We can see that we Our system is schedulable as there isn't any task misses its deadline



3. Using Keil simulator

Logic Analyzer



Note that it is the same Timeline we got from the offline simulator (Simso).

CPU Load

Watch 1		
Name	Value	Type
cpu_load	62	uint
system_totalTime	9785699	uint
system_executionTime	6154185	uint
<Enter expression>		

Note that it is the same CPU load we got from the analytical method and from the offline simulator (Simso).