

EDF Scheduler Implementation

Tasks:

- button_1 (p: 50, D: 50, E: 0.0056)
- button_2 (p: 50, D: 50, E: 0.0056)
- Periodic_Transmitter(p: 100, D: 100, E: 0.55).
- Uart_Receiver(p: 20, D: 20, E: 0.025).
- Load_1_Simulation(p: 10, D: 10, E: 5).
- Load_2_Simulation(p: 100, D: 100, E: 12).

Hyper-period:

$$\text{Hyperperiod} = \text{least common multiplier}(50, 50, 100, 20, 10, 100) = 100\text{ms}$$

CPU Load:

$$\frac{\text{total excution time (in hyperperiod)}}{\text{hyperperiod}} = \frac{(2*5.6+2*5.6+5*25)*10^{-3}+5*10+12+0.55}{100} = 62.6974\%$$

Schedulability:

URM:

$$URM = n \left(2^{\frac{1}{n}} - 1 \right) = 6 * \left(2^{\frac{1}{6}} - 1 \right) = 0.735$$

$$u = \left(\frac{5.6 * 10^{-3}}{50} \right) + \left(\frac{5.6 * 10^{-3}}{50} \right) + \left(\frac{0.55}{100} \right) + \left(\frac{0.025}{20} \right) + \left(\frac{5}{10} \right) + \left(\frac{12}{100} \right) = 0.626974 < URM$$

\therefore system is schedulable

time demand analysis:

starting from the more periodic tasks to the least.

for Load_1_Simulation:

$$w(10) = \frac{10}{10} * 5 = 5 < 10$$

\therefore Load_1_Simulation is schedualbe

for Uart_Receiver:

$$w(10) = \frac{10}{10} * 5 + \frac{10}{20} * 25 * 10^{-3} = 5.0125$$

$$w(20) = \frac{20}{10} * 5 + \frac{20}{20} * 25 * 10^{-3} = 10.025 < 20$$

\therefore Uart_Receiver is schedualbe

for Button_1:

$$w(10) = \frac{10}{10} * 5 + \frac{10}{20} * 25 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} = 5.01362$$

$$w(20) = \frac{20}{10} * 5 + \frac{20}{20} * 25 * 10^{-3} + \frac{20}{50} * 5.6 * 10^{-3} = 10.02724$$

$$w(30) = \frac{30}{10} * 5 + \frac{30}{20} * 25 * 10^{-3} + \frac{30}{50} * 5.6 * 10^{-3} = 15.04086$$

$$w(40) = 2 w(20) = 20.05448$$

$$w(50) = 5 w(10) = 25.0661 < 50$$

\therefore Button_1 is schedualbe

for Button_2:

$$w(10) = \frac{10}{10} * 5 + \frac{10}{20} * 25 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} = 5.01474$$

$$w(20) = 2 * w(10) = 10.02948$$

$$w(30) = 3 * w(10) = 15.04422$$

$$w(40) = 2 w(20) = 20.05896$$

$$w(50) = 5 w(10) = 25.0661 < 50$$

\therefore Button_2 is schedualbe

for Periodic_Transmitter:

$$w(20) = \frac{10}{10} * 5 + \frac{10}{20} * 25 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} + \frac{20}{100} * 0.55 = 10.13948$$

$$w(40) = 2 * w(10) = 20.27896$$

$$w(60) = 3 * w(10) = 30.41844$$

$$w(80) = 2 w(20) = 40.55792$$

$$w(100) = 5 w(10) = 50.6974 < 100$$

\therefore Periodic_Transmitter is schedualbe

for Load_2_Simulation:

$$w(20) = \frac{10}{10} * 5 + \frac{10}{20} * 25 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} + \frac{10}{50} * 5.6 * 10^{-3} + \frac{20}{100} * 0.55 + \frac{20}{100} * 12 = 12.53948$$

$$w(40) = 2 * w(10) = 25.07896$$

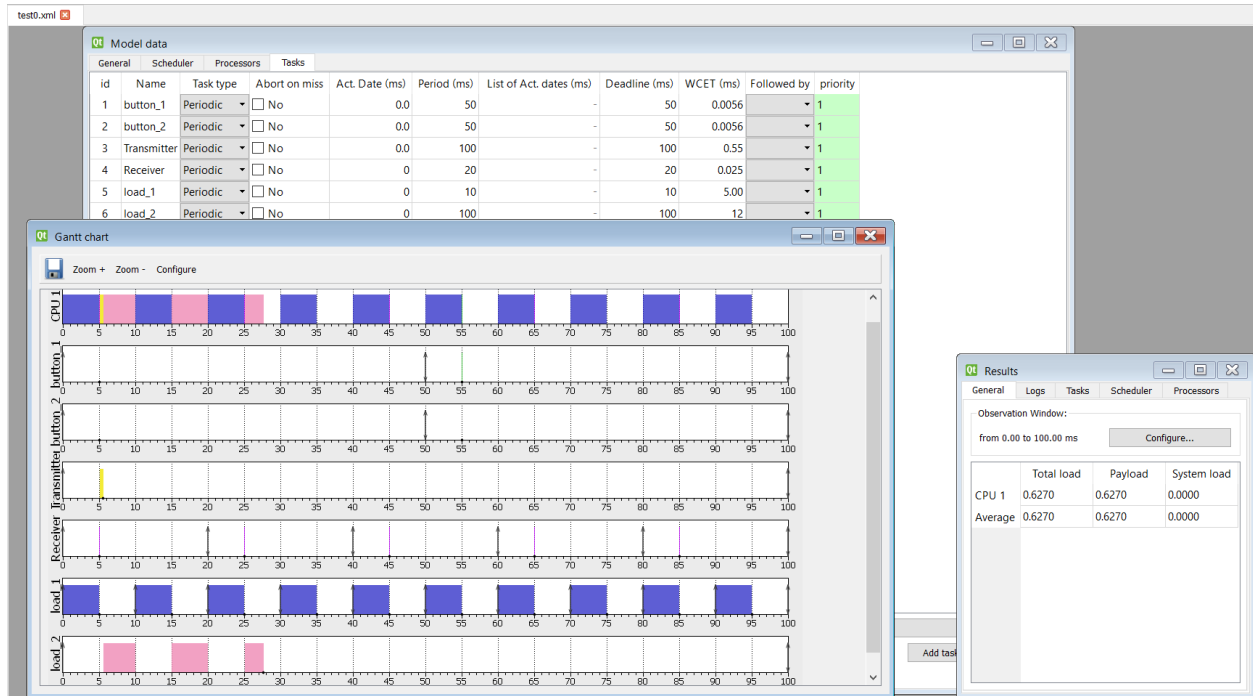
$$w(60) = 3 * w(10) = 37.61844$$

$$w(80) = 2 * w(20) = 50.15792$$

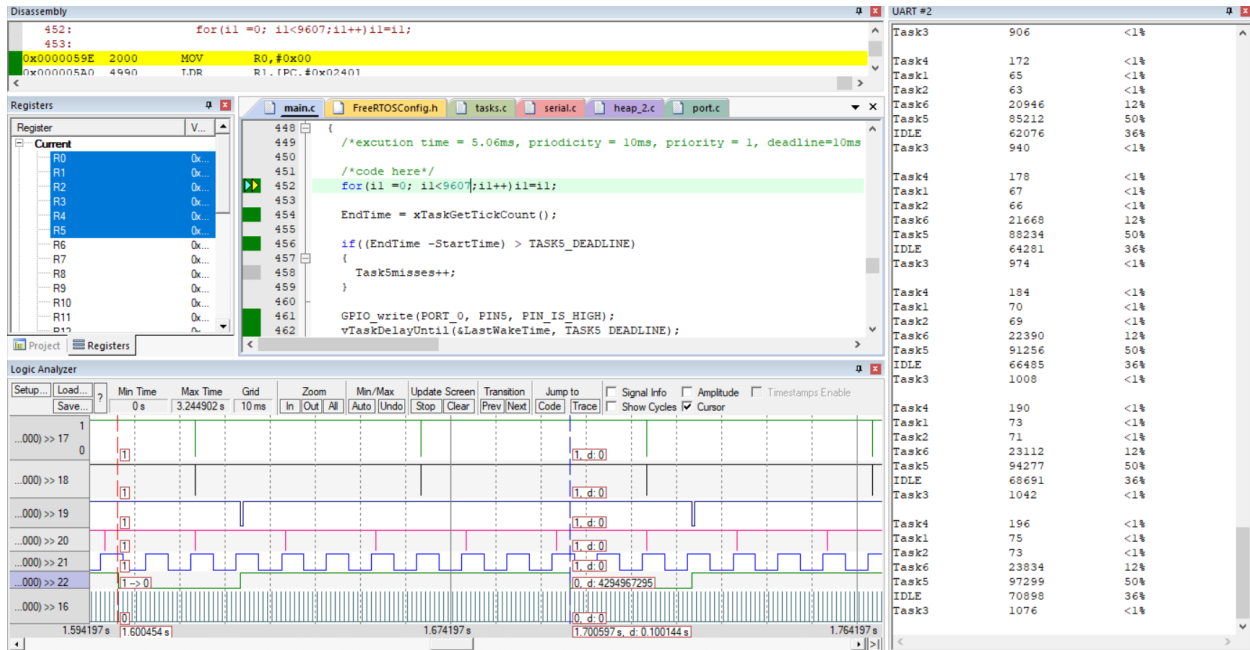
$$w(100) = 5 * w(10) = 62.6974 < 100$$

\therefore Load_2_Simulation is schedualbe

SIMSO Simulation



Keil simulator:



Conclusion

- all tasks are schedulable and there are no misses for the deadline.
- Idle task takes 36% and the load is 62.6974% so there is a loss of 1.3026% used in context switching.
- the results show that the implementation was successful.