



# **RTOS Project EDF Implementation**

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# 1. Analysis

## First Method (Using Rate Monotonic Utilization Bound)

- 1) We can compute the Execution Time for All Tasks using Logical Analyzer of Keil.
- 2) So the tasks periodic , execution and Deadline Times (ms) will be like following:

T1: {P: 50    E: 0.02    D: 50    }  
T2: {P: 50    E: 0.019    D: 50    }  
T3: {P: 100    E: 0.019    D: 100    }  
T4: {P: 20    E: 0.021    D: 20    }  
T5: {P: 10    E: 5    D: 10    }  
T6: {P: 100    E: 12    D: 100    }

### Calculations:

- 1) First Of All We will Calculate Hyper period (Critical Instant )

Hyper period = LCM (Deadlines) = LCM (50, 50, 100, 20, 10, 100) = 100

- 2) CPU Load ( Utilization ) =  $\text{Sum}(\frac{E}{P}) = \frac{0.02}{50} + \frac{0.019}{50} + \frac{0.019}{100} + \frac{0.021}{20} + \frac{5}{10} + \frac{12}{100} = 0.62201$
- 3) URM =  $n (2^{1/n} - 1) = 6 * (2^{1/6} - 1) = 0.734$
- 4) So  $0.62201 < 0.734 \rightarrow \text{CPU Load} < \text{URM}$

**System guaranteed Schedulable**

## Second Method (Using Time Demand Analysis)

- 1) First Of All We will arrange the tasks according to it priority using EDF

T1: {P: 50    E: 0.02    D: 50    }  
T2: {P: 50    E: 0.019    D: 50    }  
T3: {P: 100    E: 0.019    D: 100    }  
T4: {P: 20    E: 0.021    D: 20    }  
T5: {P: 10    E: 5    D: 10    }  
T6: {P: 100    E: 12    D: 100    }

- 2) So arrangement will be ( T5 , T4 , T1 , T2 , T3 , T6)

- 3) At any point of Time  $W(t) = E_i + \text{Sum}(\frac{t}{p}) * E_k$

- a) For **T5**  $\rightarrow W(1) \dots\dots W(5) = 5 + 0 = 5$   
 $\rightarrow W(5) < \text{Deadline of T4}$  So this task scheduled
- b) For **T4**  $\rightarrow W(1) \dots\dots W(20) = 0.021 + \frac{20}{10} * 5 = 10.021$   
 $\rightarrow W(20) < \text{Deadline of T4}$  So this task scheduled
- c) For **T1**  $\rightarrow W(1) \dots\dots W(50) = 0.02 + \frac{50}{10} * 5 + \frac{50}{20} * 0.021 = 25.083$   
 $\rightarrow W(50) < \text{Deadline of T1}$  So this task scheduled
- d) For **T2**  $\rightarrow W(1) \dots\dots W(50) = 0.019 + \frac{50}{50} * 0.02 + \frac{50}{20} * 0.021 + \frac{50}{10} * 5 = 25.102$   
 $\rightarrow W(50) < \text{Deadline of T2}$  So this task scheduled
- e) For **T3**  $\rightarrow W(1) \dots\dots W(100) = 0.019 + \frac{100}{50} * 0.019 + \frac{100}{50} * 0.02 + \frac{100}{20} * 0.021 + \frac{100}{10} * 5 = 50.202$   
 $\rightarrow W(100) < \text{Deadline of T3}$  So this task scheduled
- f) For **T6**  $\rightarrow W(1) \dots\dots W(100) = 12 + \frac{100}{50} * 0.019 + \frac{100}{50} * 0.02 + \frac{100}{20} * 0.021 + \frac{100}{10} * 5 + \frac{100}{100} * 0.019 = 62.202$   
 $\rightarrow W(100) < \text{Deadline of T6}$  So this task scheduled

**All Tasks Can guaranteed Schedulable so Over All System can guaranteed Schedulable**

## 2. Simso

### 1) Tasks Creation

Qt Model data

General Scheduler **Processors** Tasks

| id | Name | Task type | Abort on miss               | Act. Date (ms) | Period (ms) | List of Act. dates (ms) | Deadline (ms) | WCET (ms) | Followed by | priority |
|----|------|-----------|-----------------------------|----------------|-------------|-------------------------|---------------|-----------|-------------|----------|
| 1  | T1   | Periodic  | <input type="checkbox"/> No | 0              | 50          | -                       | 50            | 0.02      | ▼           | 1        |
| 2  | T2   | Periodic  | <input type="checkbox"/> No | 0              | 50          | -                       | 50            | 0.019     | ▼           | 1        |
| 3  | T3   | Periodic  | <input type="checkbox"/> No | 0              | 100         | -                       | 100           | 0.019     | ▼           | 1        |
| 4  | T4   | Periodic  | <input type="checkbox"/> No | 0              | 20          | -                       | 20            | 0.021     | ▼           | 1        |
| 5  | T5   | Periodic  | <input type="checkbox"/> No | 0              | 10          | -                       | 10            | 5         | ▼           | 1        |
| 6  | T6   | Periodic  | <input type="checkbox"/> No | 0              | 100         | -                       | 100           | 12        | ▼           | 1        |

Edit data fields...

Remove selected task(s) Add task Generate Task Set

### 2) CPU Load

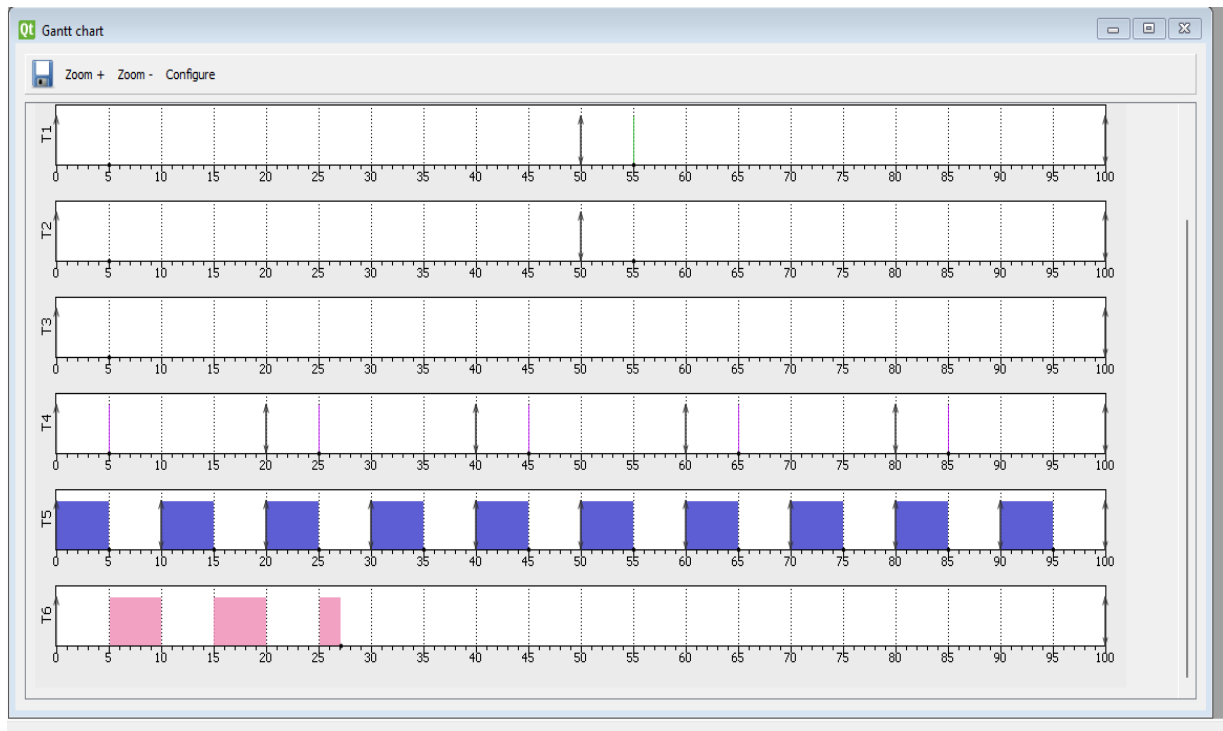
Qt Results

General **Logs** Tasks Scheduler Processors

Observation Window:  
from 0.00 to 100.00 ms Configure...

|         | Total load | Payload | System load |
|---------|------------|---------|-------------|
| CPU 1   | 0.6220     | 0.6220  | 0.0000      |
| Average | 0.6220     | 0.6220  | 0.0000      |

### 3) Gantt Chart



### 3. Keil

#### 1) CPU Load

| Watch 1            |            |      |
|--------------------|------------|------|
| Name               | Value      | Type |
| Task_1_Total       | 0x000004AC | int  |
| Task_2_Total       | 0x000004B1 | int  |
| Task_3_Total       | 0x00000461 | int  |
| Task_4_Total       | 0x000005F7 | int  |
| Task_5_Total       | 0x000312FA | int  |
| Task_6_Total       | 0x0000BDB4 | int  |
| System_Time        | 0x00061596 | int  |
| CPU_Load           | 63         | int  |
| <Enter expression> |            |      |

## 2) Logical Analyzer

