VT16 – EL2450 – Assignment II

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1 Question 1

Rate Monotonic is an scheduling method that assigns fixed priorities to tasks, proportional to its activation frequency. That means that for any given tasks J_a, J_b with periods $T_a < T_b$, J_a is assigned a higher priority than J_b.

2 Question 2

A set of periodic tasks $\{J_i\}$ is schedulable with Rate Monotonic scheduling if

$$U = \sum_i \frac{C_i}{T_i} \leq n(2^{1/n} - 1)$$

In the case where $T_1 = 20, T_2 = 29, T_3 = 35$ ms and $C_i = 6$ ms, $i = \{1, 2, 3\}$, $U = 0.678$ and $n(2^{1/n} - 1) = 0.78$. Hence tasks J_1, J_2, J_3 are schedulable with RM.

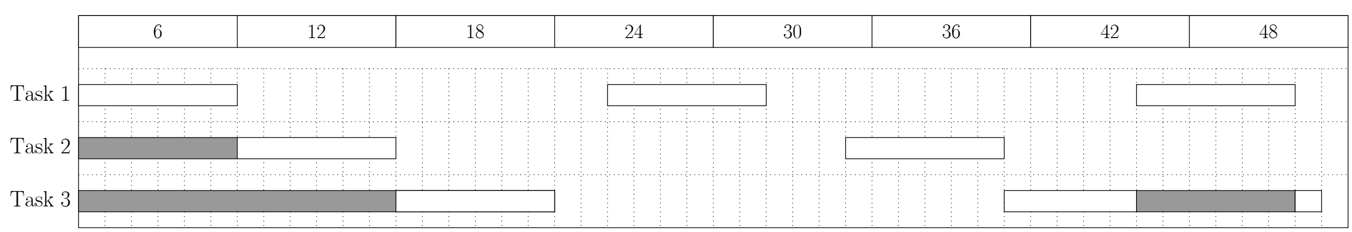

Figure 1: A portion of the RM schedule σ for tasks J_1, J_2, J_3. Shaded areas denote the waiting time.

3 Question 3

All penduli are stable. We observe that the higher the natural frequency of a pentulum, the quicker is the response both in rise and settling time, although with magnified overshoot. This makes sense since the higher natural frequency, the lower the length of the pendulum, hence the control must be swift.

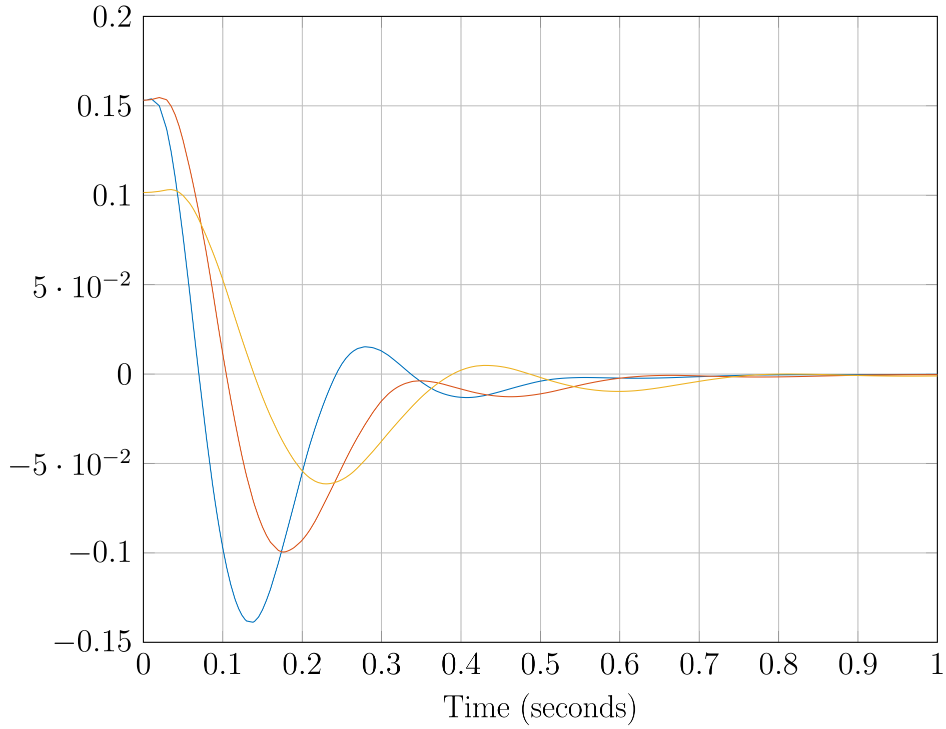

Figure 2: The angular displacement of each pendulum. `Blue`: P_1, `Red`: P_2, `Orange`: P_3

4 Question 4

Figure 3 shows the schedule calculated for each pendulum over a timespan of $lcm(20, 29, 35) =$ 4060 ms: exactly one period of the schedule. Figure 4 illustrates that the schedule is indeed feasible by ploting the overall usage of the CPU over the aforementioned time span.

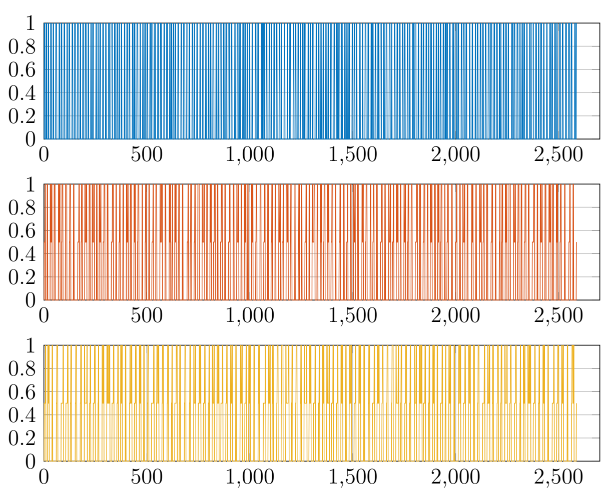

Figure 3: The calculated schedule for the three penduli. `Blue`: P_1, `Red`: P_2, `Orange`: P_3. $C_i = 6$ ms.

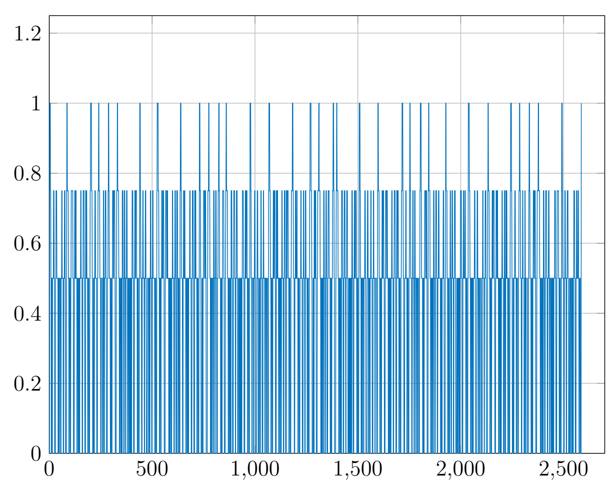

Figure 4: The overall processing usage. Notice that it is at most at 100%. $C_i = 6$ ms.

5 Question 5

Figure 5 shows the schedule calculated for each pendulum over a timespan of $lcm(20, 29, 35) = 4060$ ms: exactly one period of the schedule. Figure 6 illustrates that the schedule is indeed feasible by ploting the overall usage of the CPU over the aforementioned time span.

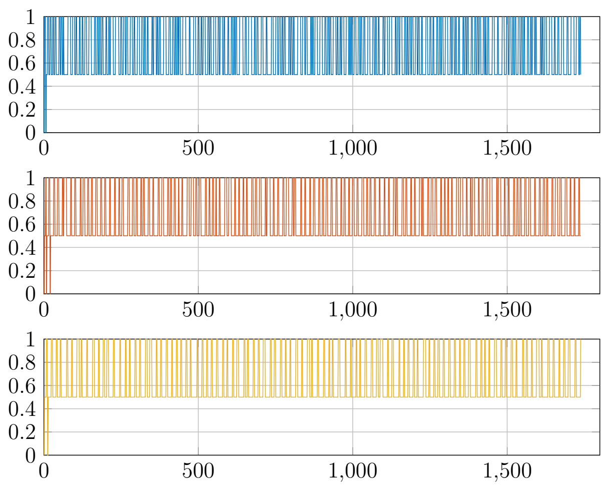

Figure 5: The calculated schedule for the three penduli. `Blue`: P_1, `Red`: P_2, `Orange`: P_3. $C_i = 10$ ms.

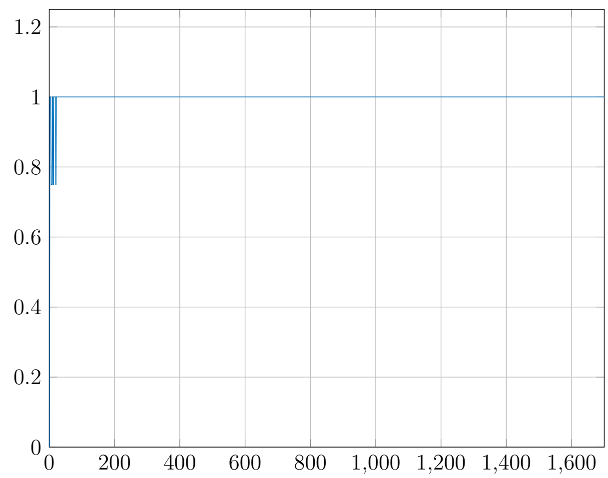

Figure 6: The overall processing usage. Notice that it is at most at 100%. $C_i = 10$ ms.