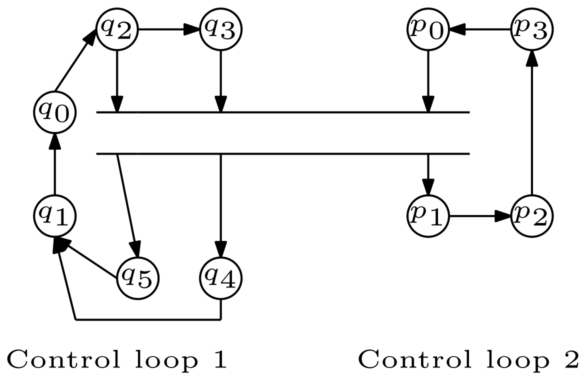

Fig. 1. *Control Loop sharing bus*

Problem Objective: According to our last discussion, I have tried to model the solution in such a way so that it can be solved by Rabin's acceptance condition. In case of buchi automata, we have drawn the possible sequence with the control states and selected them who were exponentially stable. But exponential stability can be calculated if the states are represented by matrices. Here I have considered automata to represent control loops, so we cannot apply exponential stability as an acceptance condition.

To model such a situation, I have used Rabin's tree acceptance condition. How I can use it, I have explained later on.

System Description: In the above diagram there are two control loops sharing a common bus. From control loop1, q_2 and q_3 states are sharing the bus and from control loop2 p_0 is also sharing the bus. So these three states are sharing the bus.

Solution method: There are L^n sequences possible for scheduling the bus access with n states. Now for 3 length sequence with 3 states the possible combinations are $3^3 = 27$ sequences. The tree automata for the above states can be represented as follows

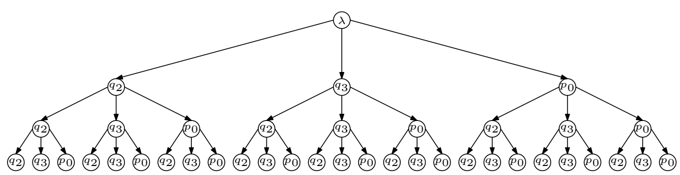

Fig. 2. *Tree automata for scheduling sequence*

A Rabin automaton on $\sum$-trees is a tuple $A = (Q, qo, \sigma, T)$ where Q is a nonempty finite set of states, $q_0 \epsilon Q$ (the initial state), $\sigma \subseteq Q \times \sum \times Q \times Q$ (the set of transitions), and $T = \{(L1, U1), ..., (LN, UN)\}$ where $Li, Ui \subseteq Q$ (the collection of accepting pairs of states).

Now if I define Acceptance condition for the above tree as $T = \{(q_2, q_3), (\phi, p_0)\}$. So from the above tree those paths will be accepted which do not have q_2. Removing all sequences which have q_2 as one of their states, we have the remaining sequences with only states q_3 and p_0. These are:

$p_0p_0p_0$, $p_0p_0q_3$, $p_0q_3p_0$, $p_0q_3q_3$, $q_3p_0p_0$, $q_3p_0q_3$, $q_3q_3p_0$, $q_3q_3q_3$

With these remaining states, we can construct the state transition table, that we have done earlier, will find a cycle, the state alphabets will comprise of these two states.

Now consider that Control loop 1 is got replaced and has now the construct depicted in Fig. 3.

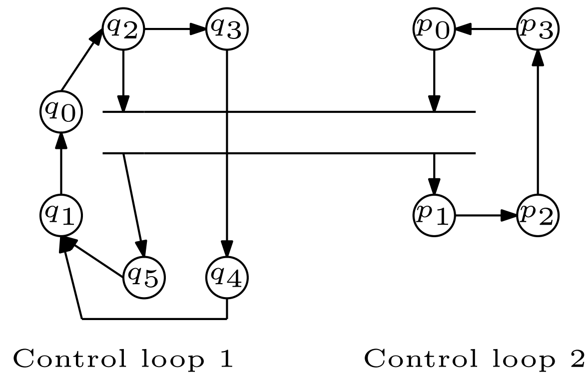

Fig. 3. *Control Loop sharing bus*

In the above diagram, q_3 from control loop 1 is not sharing the bus, only q_2 is sharing. But now if we draw the tree automata, and tried to apply Rabin's Acceptance condition that we have considered, then we will find that only $p_0p_0p_0$ will be the only remaining state.