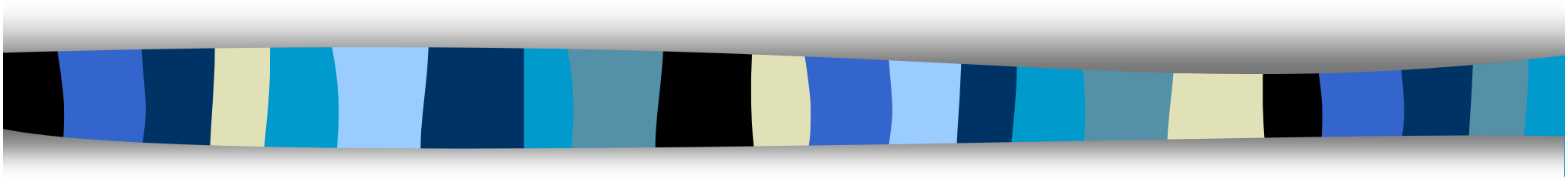
Context-Dependent Network Agent

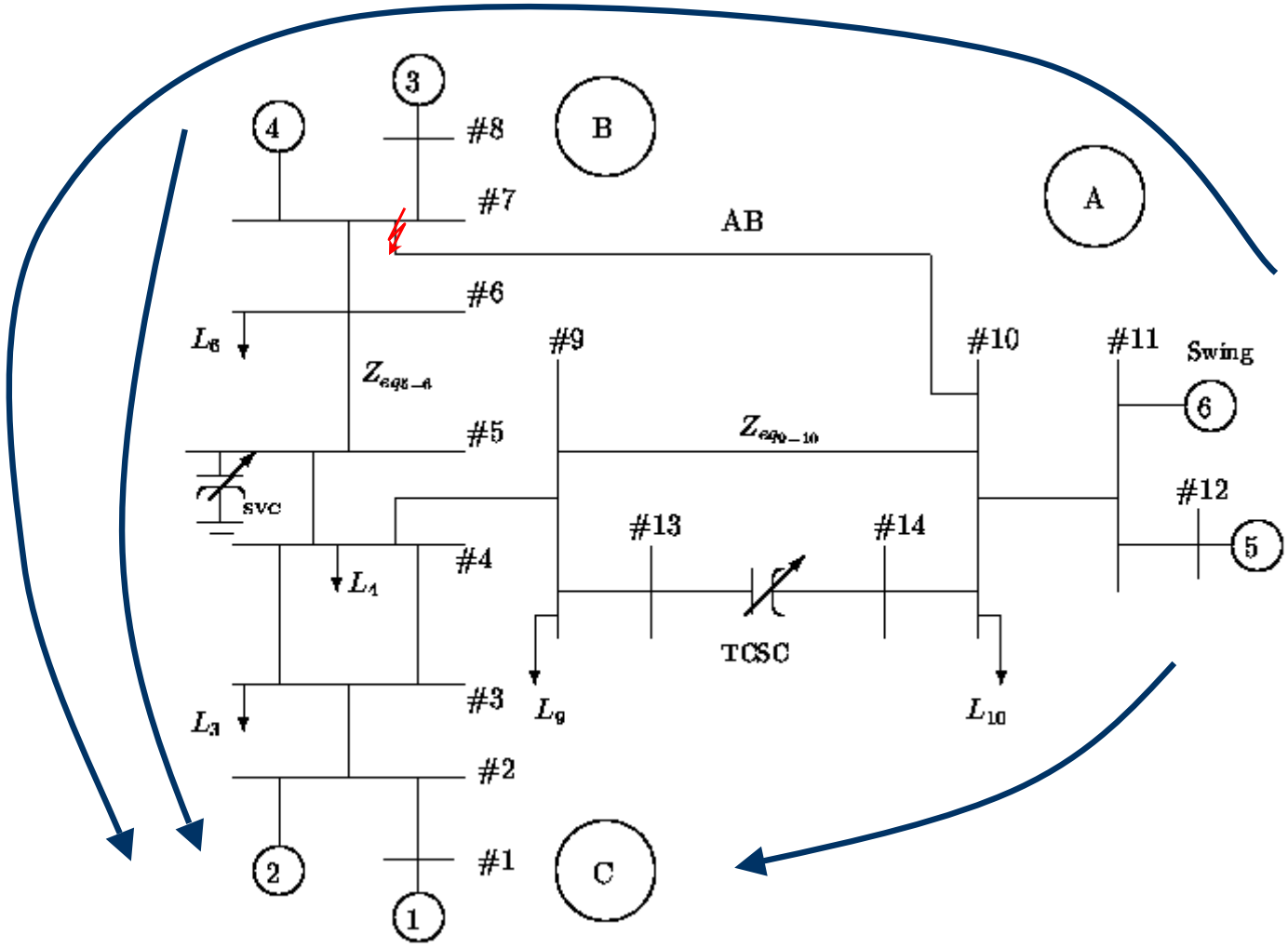


Dong Jia

Outline

- A Power System Example
- Research Problems

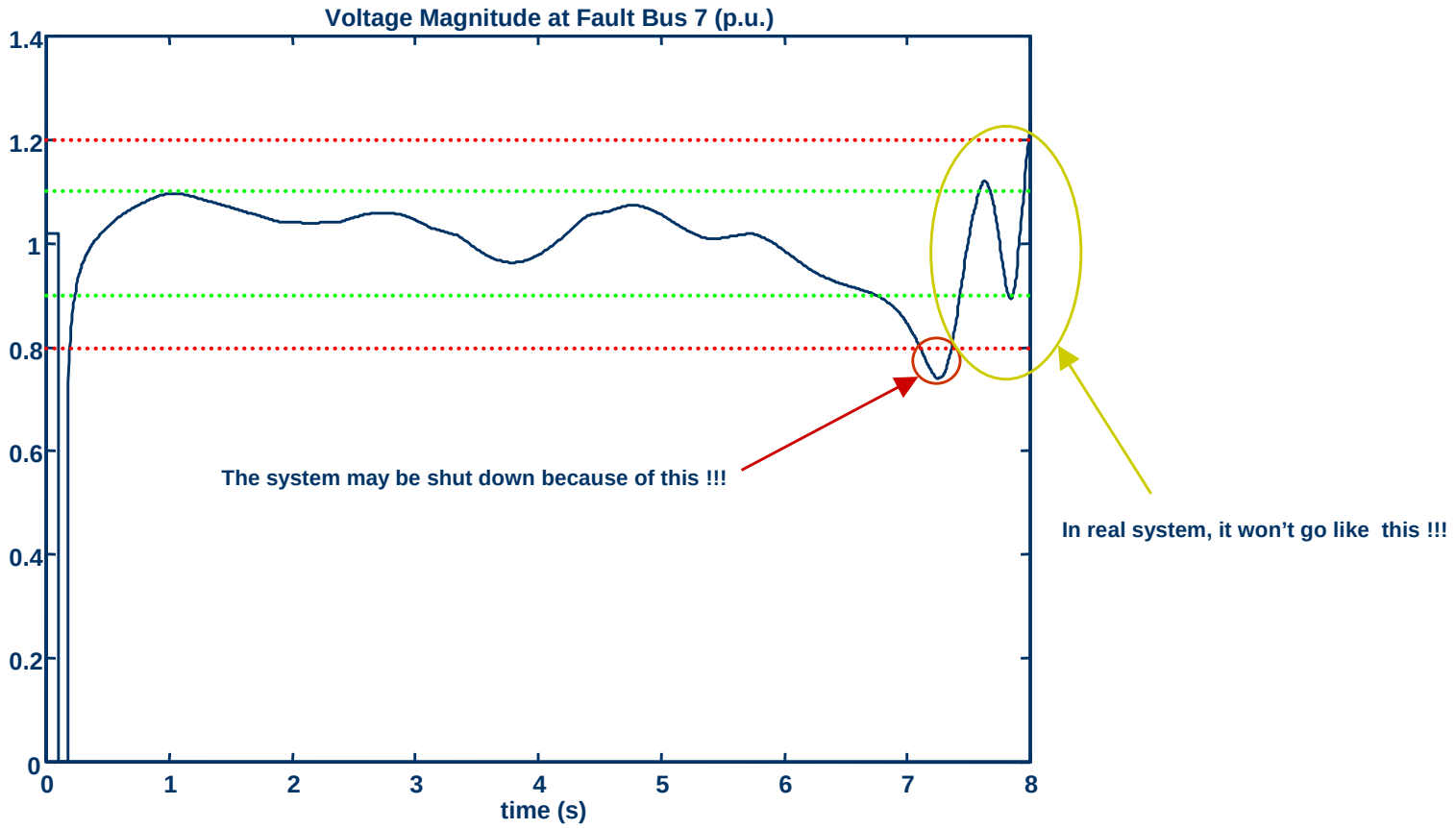
An Power System Example



Switching Control Scheme

- For each control device, SVC & TCSC, there are two controllers: pre-fault controller and post-fault controller.
- To detect the fault, The SVC monitors the power flow through line 4-5 and the TCSC monitors the power flow through line 4-9.
- Only the power flow goes beyond the threshold value for a certain time, the control device can say there is a fault happening.

Simulation Results



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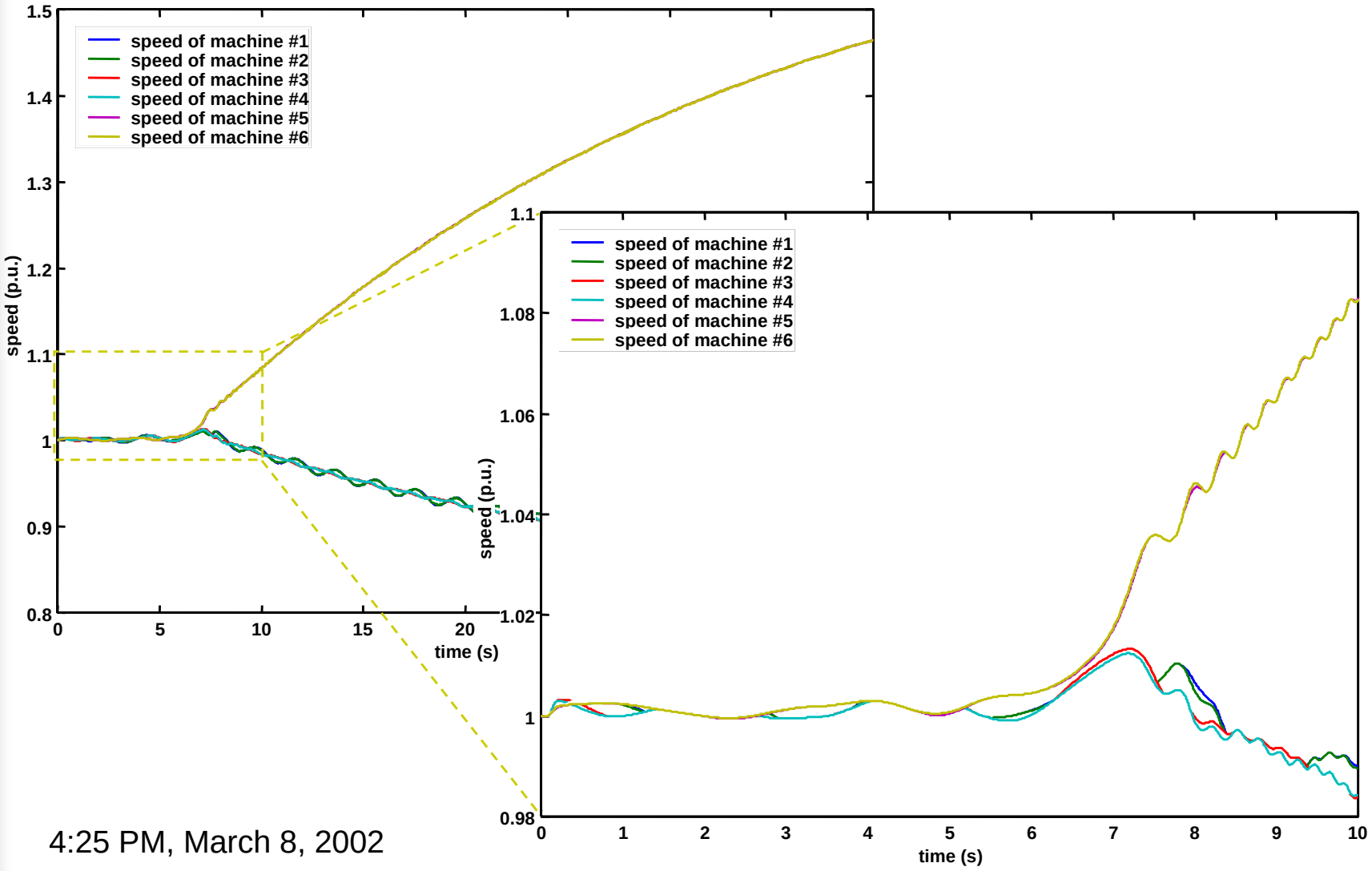

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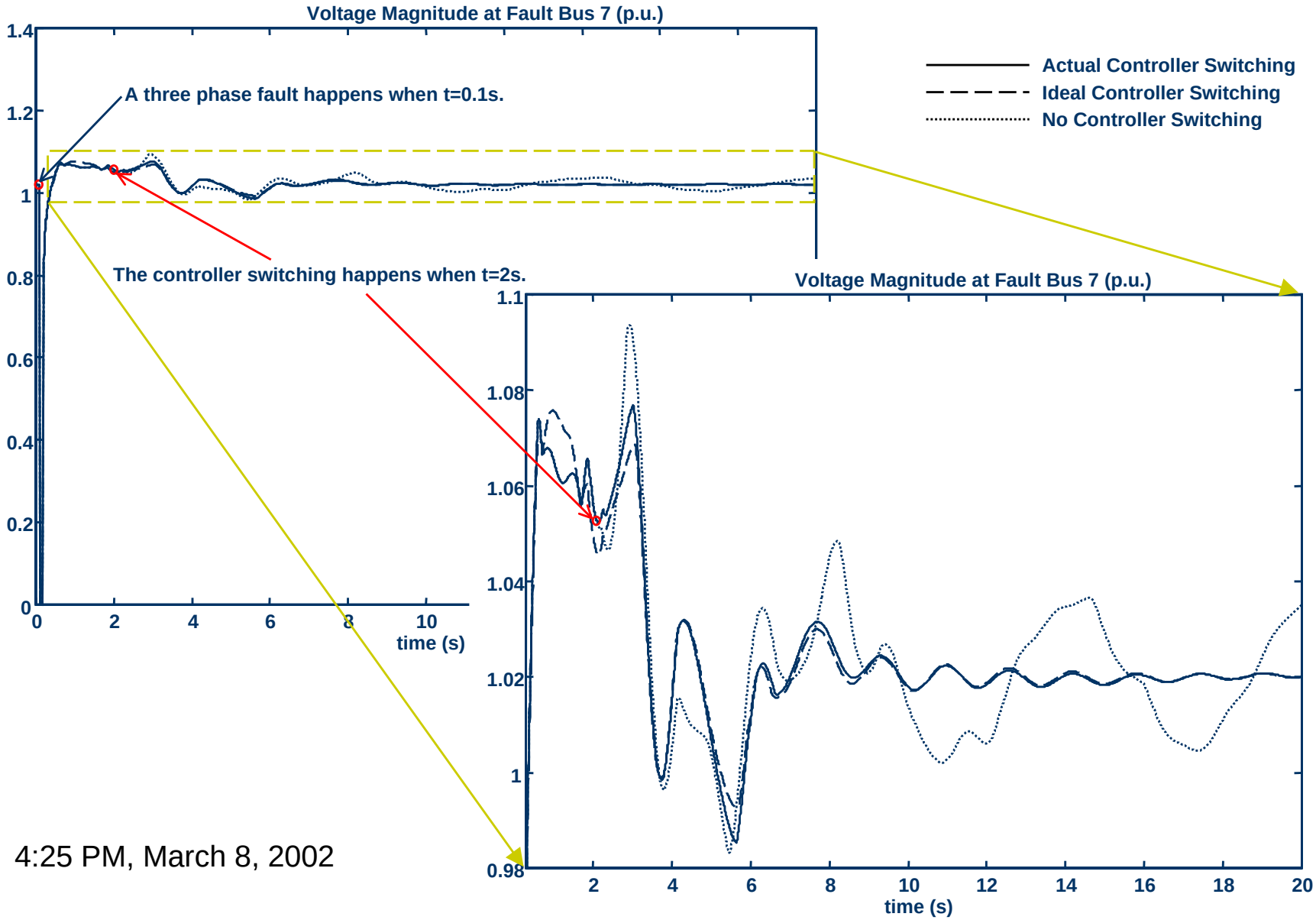
Simulation Results



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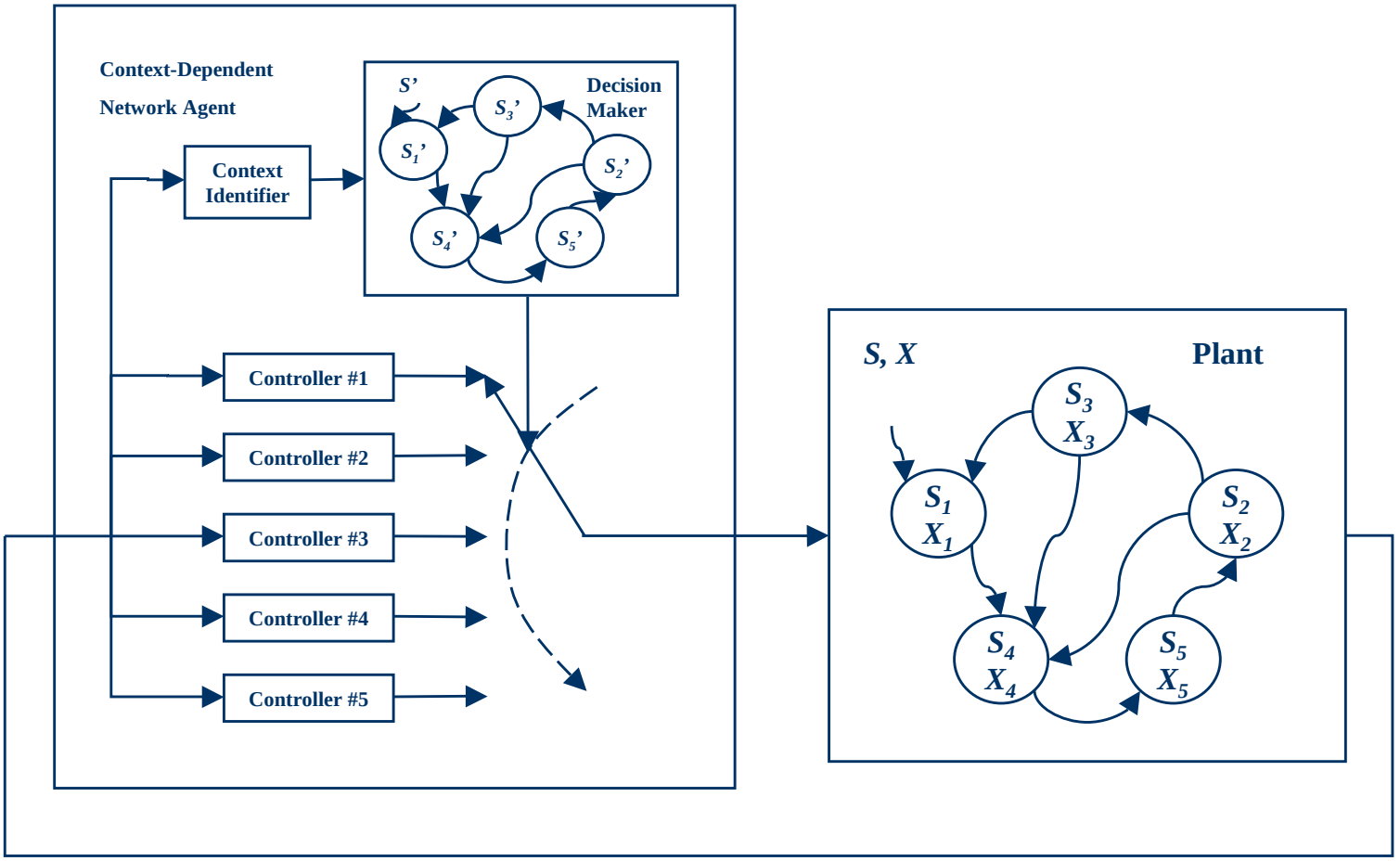
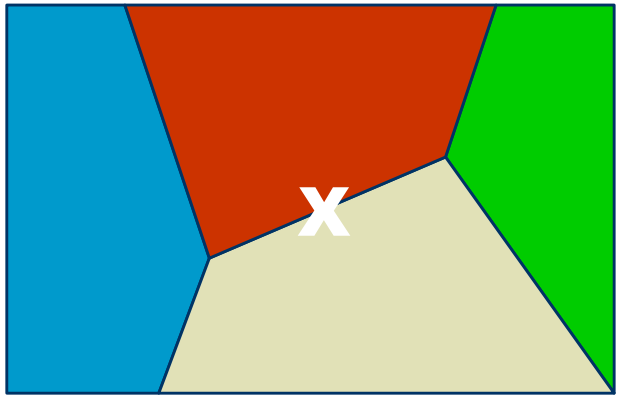
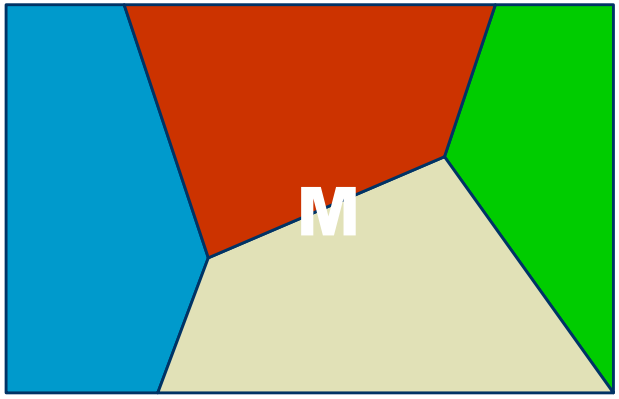
Context Dependent Network Agent



Discrete State





State Space Aggregation

- **In one discrete state, the continuous behavior is described by one time driven model**
- **Discrete state is defined based on state space**
- **In different discrete states, there is no overlap between the corresponding areas in the state space**

Model Space Aggregation

- **In one discrete state, the continuous behavior is described by one time driven model**
- **Discrete state is defined based on model space**
- **In different discrete states, there may be overlaps between the corresponding areas in the state space**

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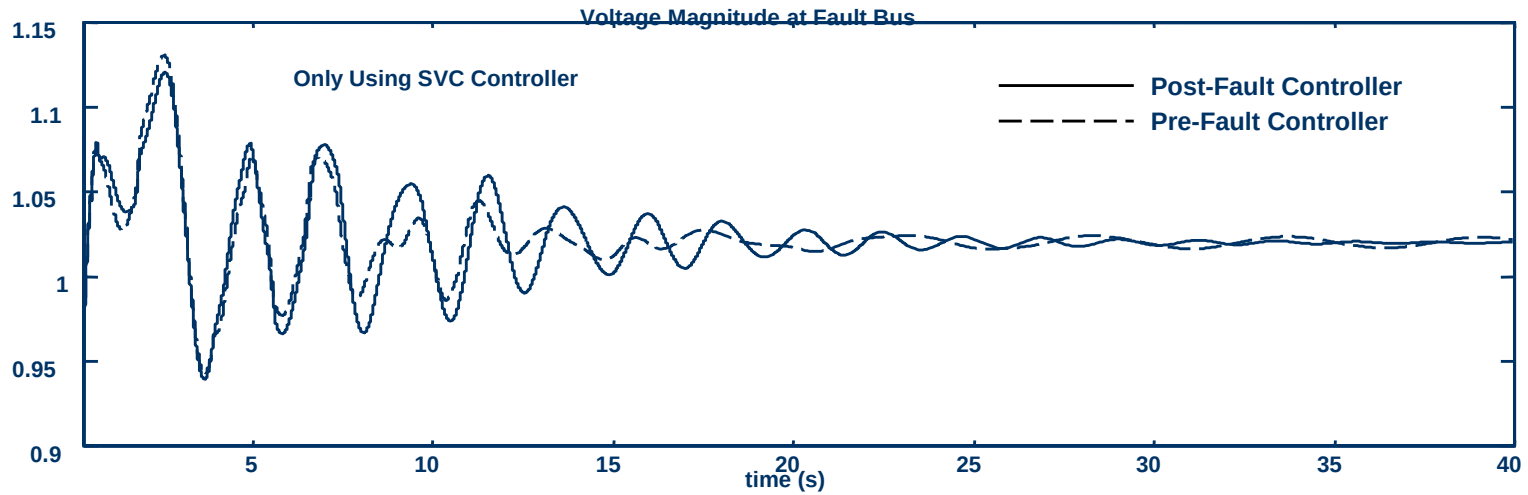
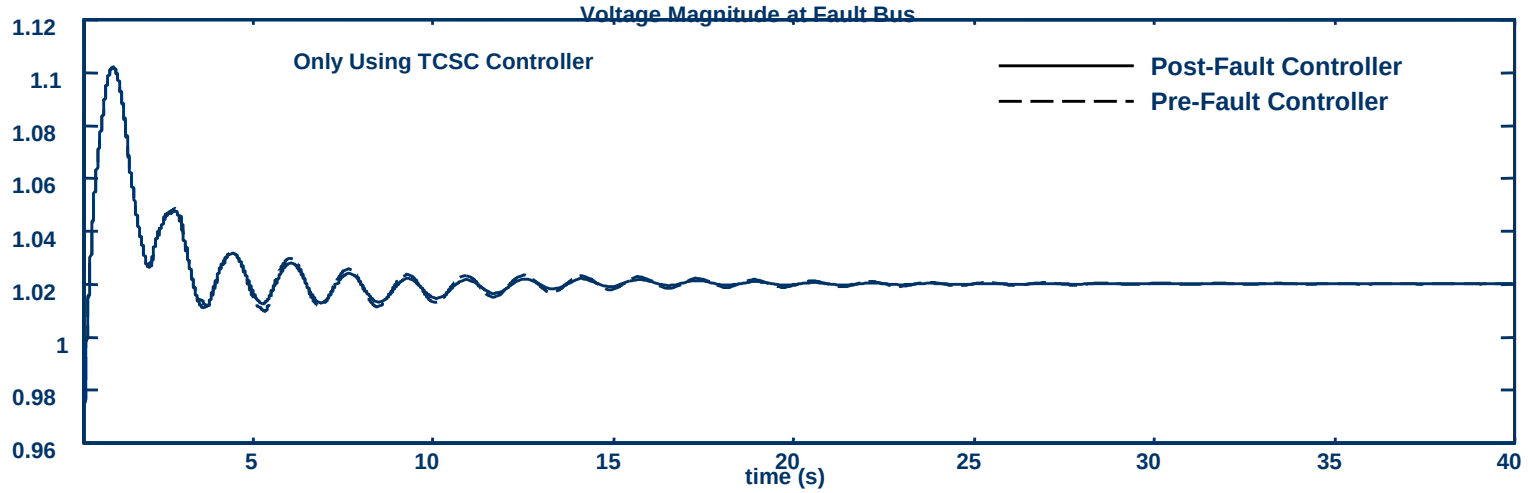
Reconfigurable Control

- There should be enough models such that at any time the error between one model and the system is small enough.
- The model with the smallest prediction error will be activated and the corresponding controller will be switched on.
- This is still done is a centralized fashion.

Need Multi-Controllers?





Coverage Problem

We have a set of models $\mathscr{M} = \{M_1, M_2, \cdots, M_n\}$ and a set of controllers $\mathscr{C} = \{C_1, C_2, \cdots, C_n\}$ which are specifically designed for one models. Then we get a set of open regions $\mathscr{D} = \{D_1, D_2, \cdots, D_n\}$ such that $M_i \in D_i$ and C_i is satisfactory for any model in D_i, $i = 1,2,\cdots,n$. We want to check whether the union of these open regions $\bigcup_{i=1}^{n} D_i$ covers the whole model space. If not, we need to add new model, new controller and new open region.

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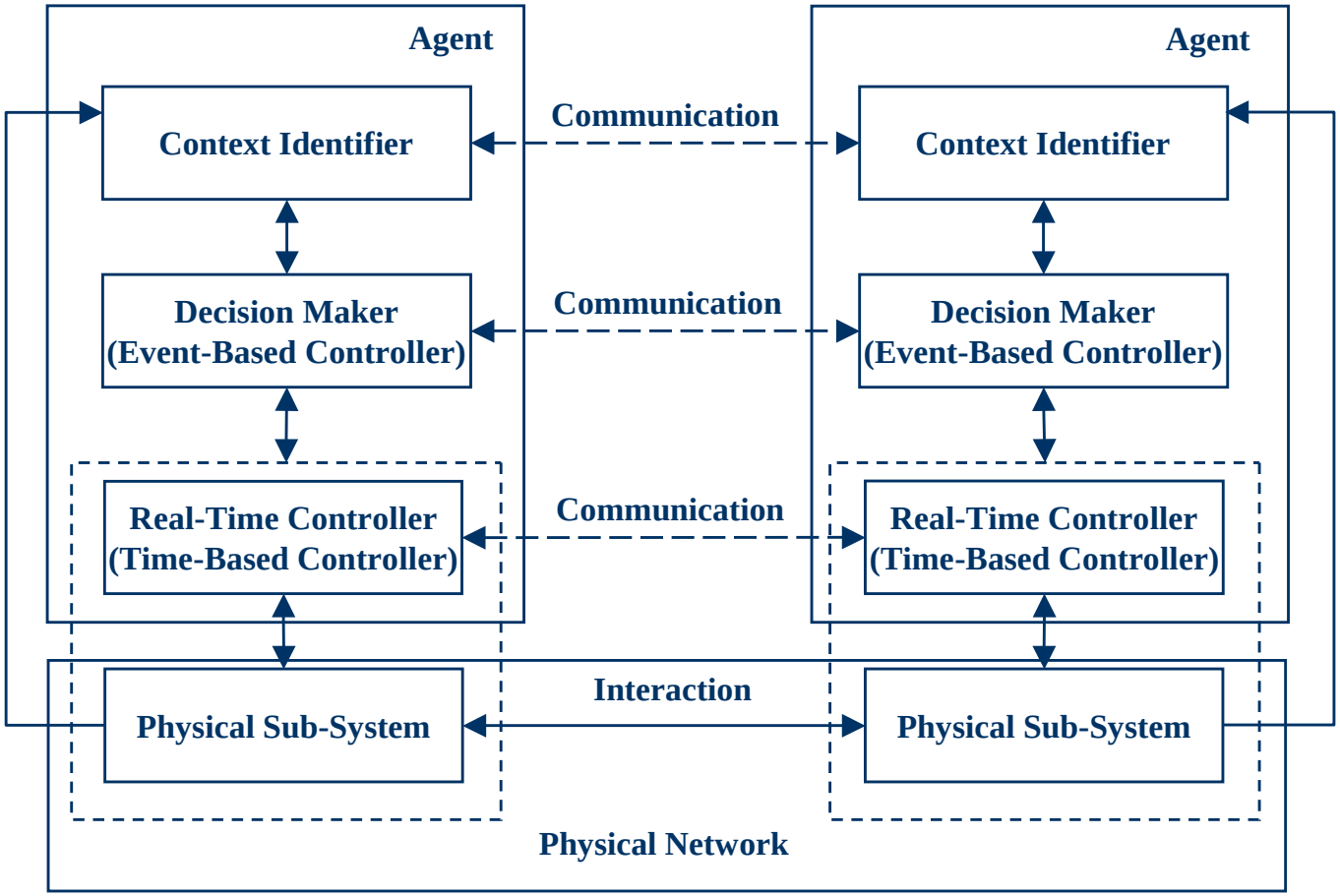
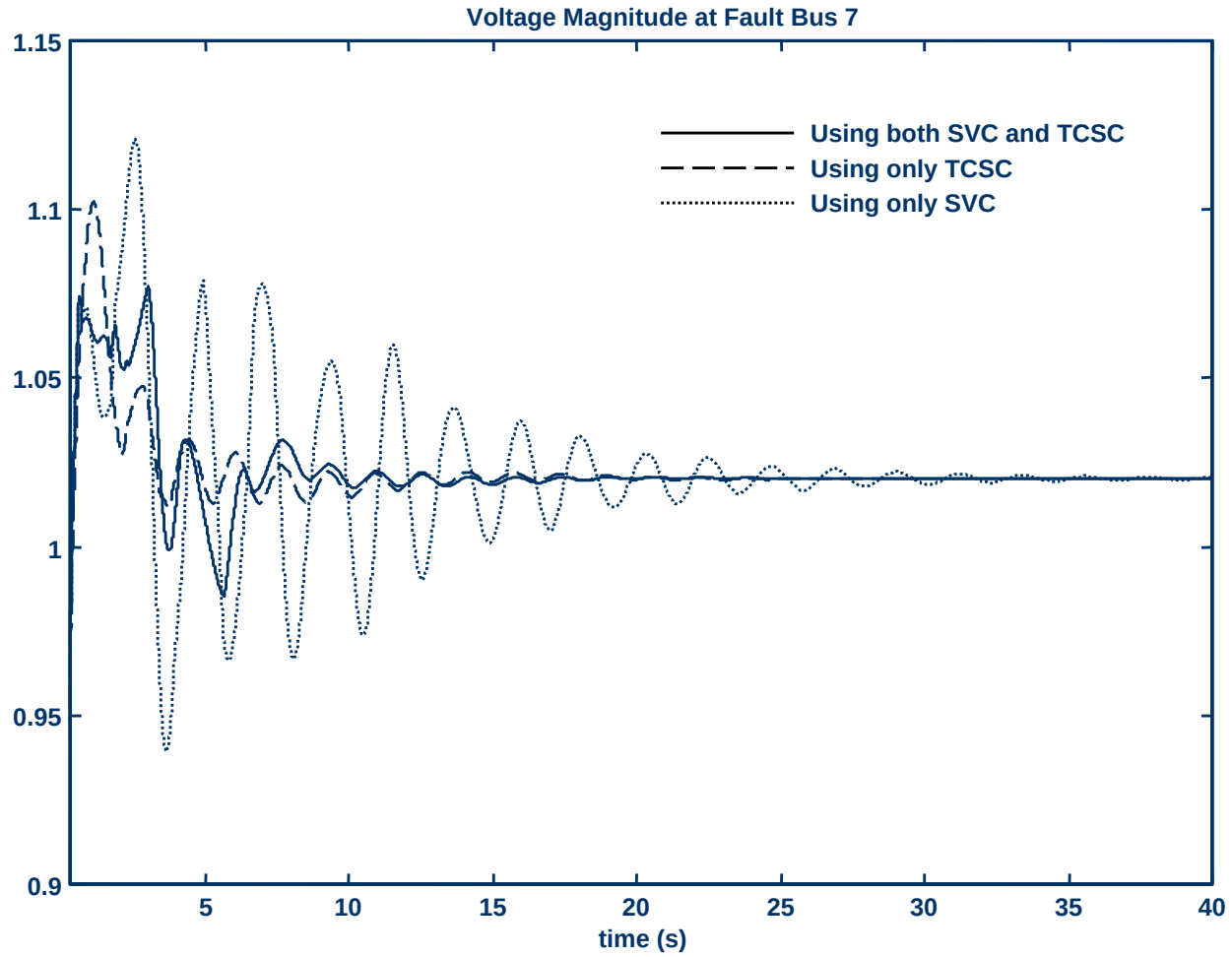
System Structure



Need Coordination?



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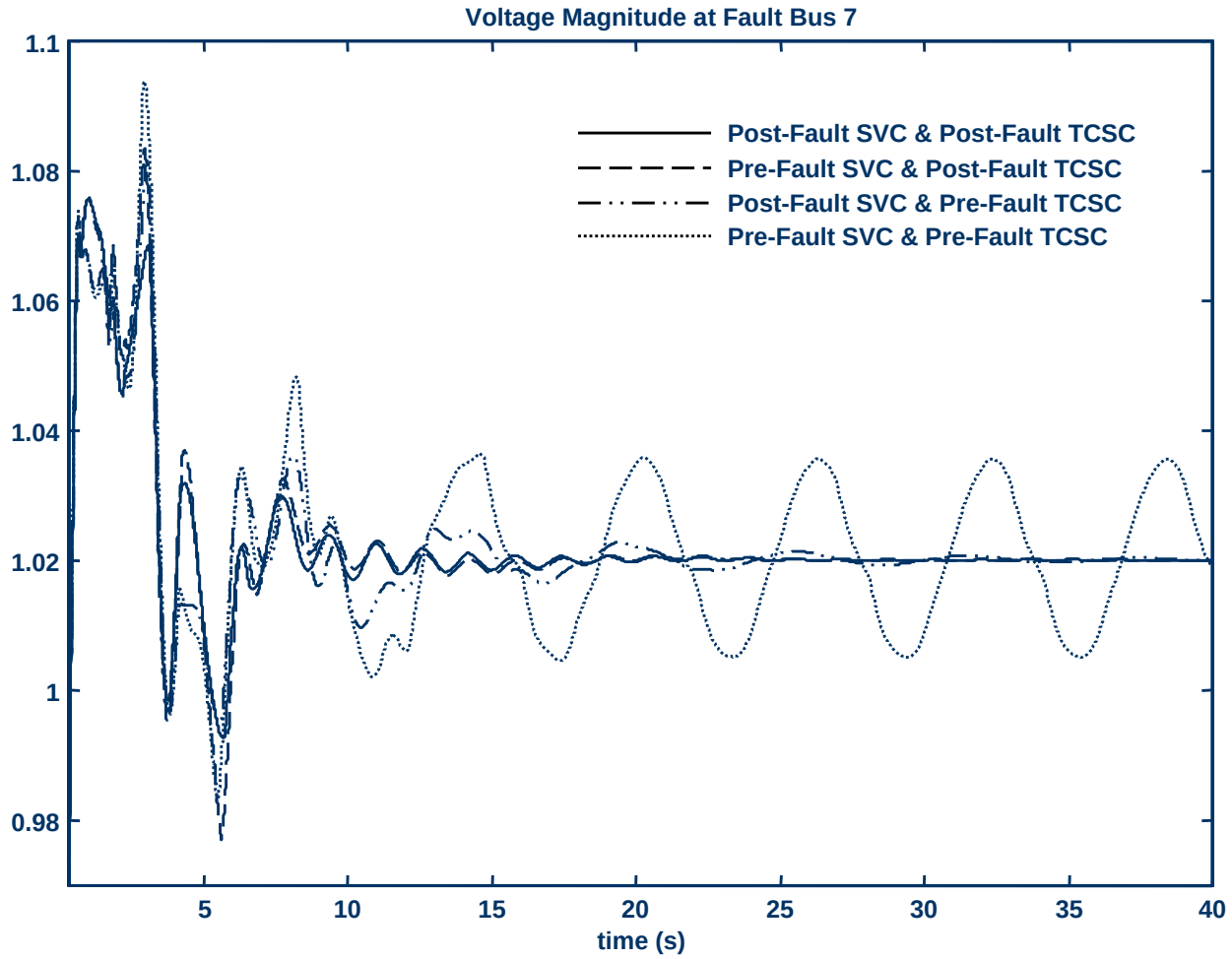
How To Coordinate?



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Coordination Problem

How should they coordinate in each level?

- Context Identification

  Notify other agents when one agent detects new context.

- Decision Making

  Which one should switching on the new controller?

- Real-Time Control

  When must it take care of the effect from other agents? When does it not have to worry about that?

These need coordination in design.

Current Work

- Develop a framework to study this context dependent network agent problem.
- Develop power system example to test the context dependent network agent idea.

List Of Problems

- What is good performance?
- What is the distance between two models?
- How to identify discrete state?
- How to guarantee the stability?
- Who is neighbor agent?
- When to coordinate?
- ……