

CCS-Lund Collaboration MS Thesis Topics

Dynamic modeling and control for fire suppression systems

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Summary

The purpose of this note is to outline an area of collaboration between CCS and the Department of Automatic Control at Lund University. The intent is to develop a series of MS thesis areas and to have MS students working in CCS design centers with UTC mentors. This document describes one area that is of mutual interest and also gives a structure for the collaboration in listing the area, the mentors, the location that the student will work at and identifies the type of publishable work that is expected to emerge from the work.

MS Thesis Topics & Support

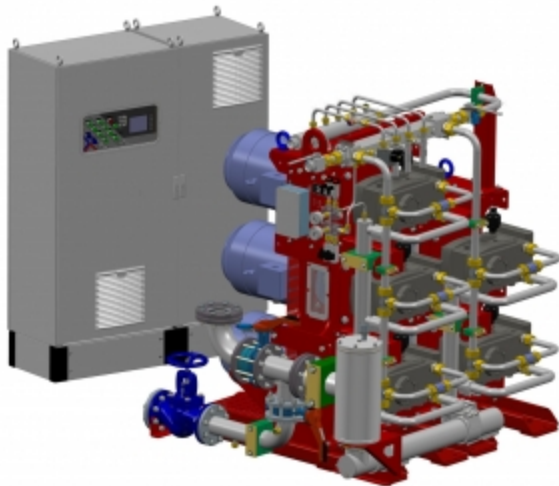
1) System modeling for electric pump unit:

a) Background

HI-FOG[®] Electric Pump Unit (EPU)

The HI-FOG[®] Electric Pump unit consists of a mechanical pump skid and a separate control cabinet. Its unique modular structure enables flexible installation and optimized use of footprint. The advanced control system ensures that the pump unit provides only the required pressure and flow. Pressure optimization is achieved with the software control and a frequency converter. Excess water unloading is not needed, which simplifies the mechanical design.

The EPU's user-friendly interface provides real-time status of the pump unit and the HI-FOG[®] system, alarm and help information, maintenance reminders and event history ensuring optimized maintenance activities.

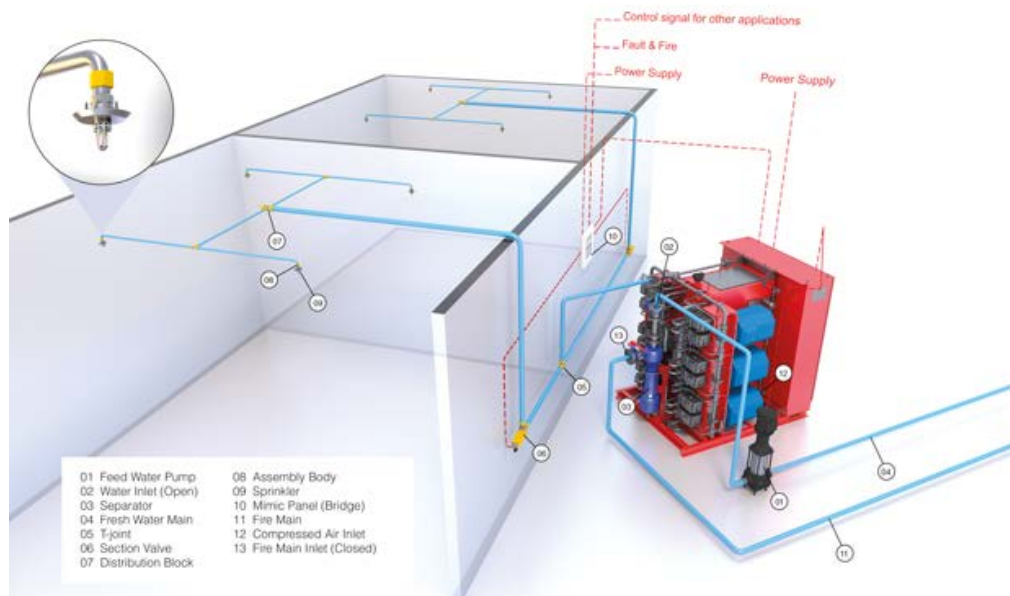


b) Challenges

There is no dynamic model existing now in CCS. A good electric pump unit (EPU) model plays key role to expedite EPU control development and testing. Due to fast dynamics of the equipment with mechanical and electrical components, it is not an easy task to develop a high fidelity EPU model applicable for control algorithm design and verification and testing as a virtual EPU.

2) Water network distribution system model with multiple EPUs

a) Background



Wet pipe system uses automatic sprinklers attached to a piping system containing water and connected to a water supply so that the water discharges immediately from sprinklers operated by the heat from a fire. Wet pipe systems are typically used in accommodation and similar areas with solid combustibles.

b) Challenges:

System level control of multiple EPU development depends on field tests in customer sites. Characterization of dynamic effects and timescale of high pressure water pipe network can be challenged for modeling.

Mentor and Supporting Team

- James Fan/Kristian Tuszynski/Pengfei Li (Mentors)
- Gian Minardi (Marioff, need to confirm)

What is new & publishable?

- 1) Dynamic modeling of water network with anticipated undesired dynamic effects (such as unknown volume of air inside water pipe).
- 2) System modeling of electric pump unit (after removing CCS proprietary information)

Location

Spend several weeks with Marioff engineers in Vantaa, Finland in the beginning of the project to be familiar with the system and have a final visit to demonstrate the simulation with the models.