# Master Thesis Project Proposals

Saab Kockums

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# Our broad offering

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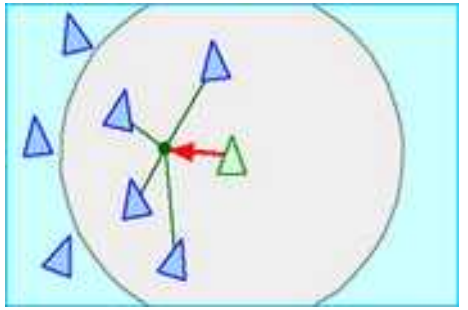
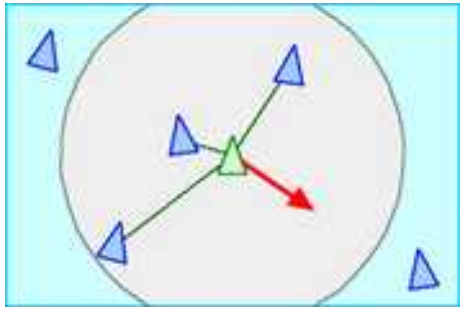
# Formation Control of USVs

- Explore multiple vessel behaviour
- Possible approaches
  - Have USVs act as “Boids” and simulate flocking behaviour of birds.
  - Joint path following and collision avoidance.
- Field test possibilities late spring – in coordination with WASP WARA-PS and Saab Kockums.





- Contact: birgitta.wingqvist@control.lth.se

https://en.wikipedia.org/wiki/Boids
https://wasp-sweden.org

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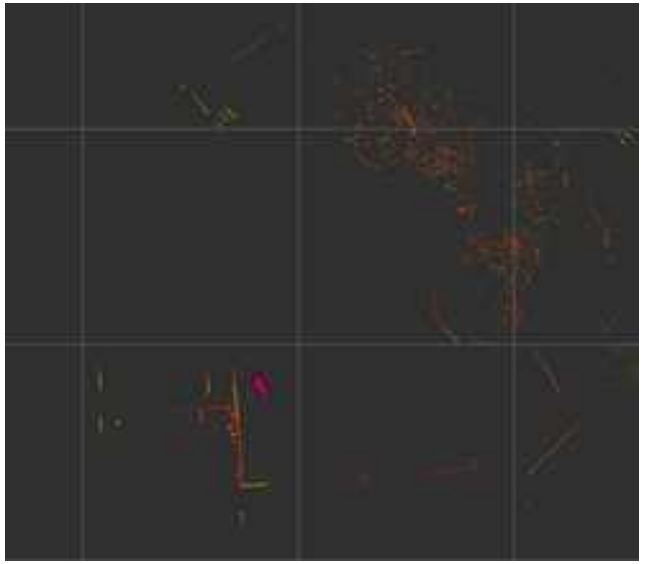
# USV Docking

- To autonomously have the boat approach a pier.
  - Relative positioning
    - Lidar etc
  - Motion planning and control
    - Fine manoeuvring, possibly using MPC
    - Collision avoidance, static ans dynamic obstacles
- Field test possibilities late spring – in coordination with WASP WARA-PS and Saab Kockums.
- Builds on Master Thesis project performed in Spring 2022*.
- Contact: birgitta.wingqvist@control.lth.se



* S. Kockum , Autonomous Docking of an Unmanned Surface Vehicle using Model Predictive Control, 2022
http://lup.lub.lu.se/student-papers/record/9096721.

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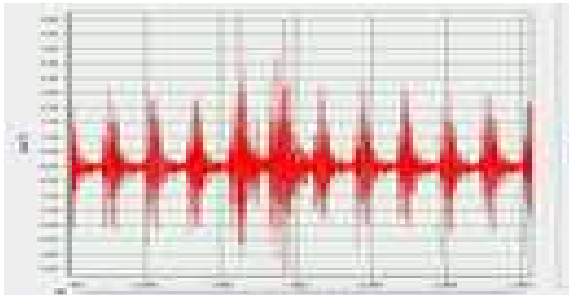
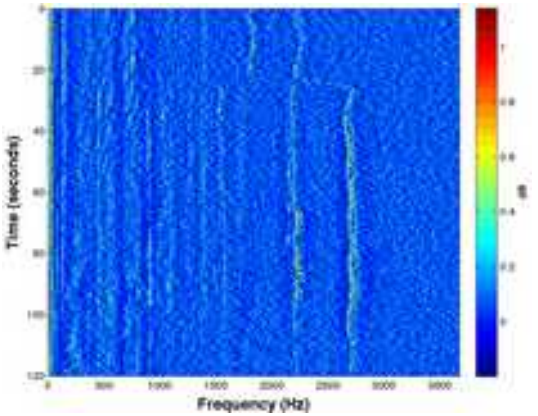
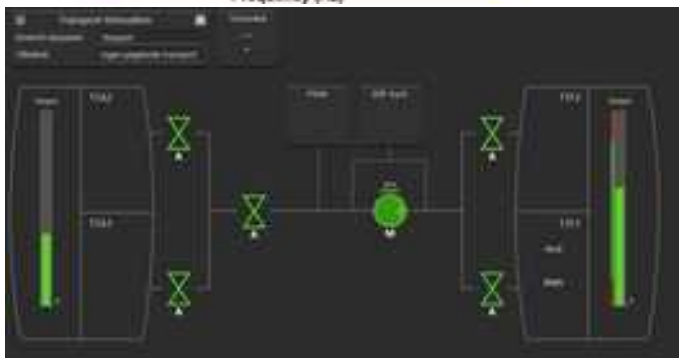
# Sensor fusion analysis with AI/ML

- Automatically detecting the abnormality of a vessel's state
  - Learning methods and training data are major challenges.
  - Investigate how, with the help of machine learning, external sensors (e.g. sound and vibration) can be used to detect a changed behavior of a single or multiple rotating machine(s).
  - This is trained against temporary sensors such as machine status (ground truth).

- Contact: joakim.truuberg@saabgroup.com





# Time delay in simulation with real-time systems

- Simulation with real-time systems time delays occur can cause unwanted behavior in, for example
  - control algorithms in the real-time system
  - make it difficult to adjust controller parameters.
- Possible approaches
  - Investigate where delays occur in the simulation
  - Develop a model for how the delays affect control algorithms in real-time systems
  - Develop proposals for how these can be compensated

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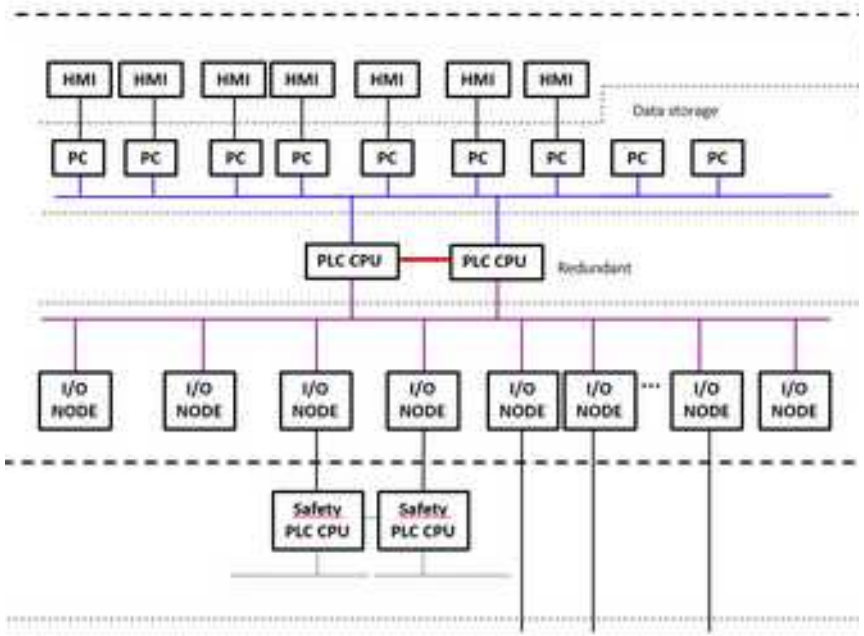
# Predictability and scalability model of PLC performance

- When designing a PLC system, components are initially selected based on an expected degree of utilization and have an estimated margin for expansion. There is a need to
  - quantify utilization rate and thus margin
  - overview of how close you are to the capacity limit
  - identify which measures could reduce load in the system
- Possible approaches
  - Investigate how the PLC system is affected by adding network nodes, IO signals, communication interfaces, etc.
  - Develop a model to predict how future up scaling of the system will affect performance
- Contact: joakim.truuberg@saabgroup.com







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