



## PROSJEKTOPPGAVE

Kandidatens navn: **NN**

Fag: **Teknisk kybernetikk**

Oppgavens tittel (norsk): **Følging og inspeksjon av undervanns rørledninger ved bruk av AUV**

Oppgavens tittel (engelsk): **AUV pipeline following and inspection**

Oppgavens tekst:

Pipeline owners normally inspect their pipelines at regular intervals in order to ensure operation and detect any problems that need attention. On the outside, the condition of the pipe as well as the close proximity of the pipe is of special interest. This includes free-spans, damage and defects, leaks, cathodic corrosion and pipeline movement. Also identifying objects like debris, fish nets and World War II mines caught on the pipe or in the vicinity is of great importance to the pipeline owners.

Today Remotely Operated Vehicles (ROV) are normally used for pipeline inspection surveys for subsurface installations. Using an Autonomous Underwater Vehicle (AUV) equipped with appropriate sensors and capabilities could free up resources and reduce the cost for such a survey. This would require the AUV to be able to follow the pipeline without human intervention based on sensor information, identify abnormalities and perform a closer inspection if required.

In this project a control system for AUV pipeline following and inspection shall be designed. The AUV is equipped with an underwater camera for identification, tracking and inspection of the pipeline. Assume a HUGIN 1000 type AUV with the following capabilities:

- Complete guidance and control system with hovering capabilities in the translational x, y and z directions and rotation around its z-axis.
- An underwater camera directed downwards provided with light sources to allow for operation in varying light-conditions.

The assignment consists of several steps:

1. Do a literature survey on pipeline inspection using ROVs and AUVs.
2. Develop a simplified model for a HUGIN 1000 type AUV with the specified capabilities.
3. Develop a camera model/simulator and tracking system for the specified use.

4. Design and implement a guidance system for pipeline following and inspection able to:
  - a. Track the pipeline based on inaccurate predefined positions (“as laid”) aided with the information from the camera based tracking system.
  - b. Handle sections where the pipeline is buried and perform appropriate search maneuvers in order to regain track
  - c. Maintain a given height (3-5m) directly above the pipeline during inspection.
5. Consider the use of any additional aiding sensors like multi beam echo sounder and side scan sonar.
6. Perform simulations of the developed system demonstrating the stated capabilities and discuss its performance.

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Utført ved Institutt for teknisk kybernetikk

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