# Risk Aware Control of Underwater Snake Robots in Confined Environments

The growing interest in ocean discovery imposes a need for inspection and intervention in confined and demanding environments. To tackle these demanding environments, articulated underwater snake robots, such as Eely, with their slender shape and adaptable body configurations, have emerged as a viable solution. However, operating Eely in such environments presents a set of complex challenges. It must navigate through uncertain and unstructured surroundings, withstand extreme environmental conditions, and overcome limited navigational capabilities.

This thesis addresses these challenges by proposing a Bayesian approach to assess the risks associated with the loss of Eely during mission scenarios. The primary goal of the thesis is to enhance Eely's performance and increase the likelihood of mission success. In addition, an altitude controller based on a nonlinear Fractional Order PID (FOPID) controller is proposed. This controller aims to regulate and stabilize the altitude of Eely underwater snake robot.

Through simulations, the proposed controller is evaluated to demonstrate its robustness and effectiveness in controlling the altitude of Eely. The simulations provide valuable insights into the controller's performance in diverse underwater conditions, including scenarios with uncertain and unstructured environments. The simulation results are compared to the results obtained from field experiments in which similar tests are conducted.

Moreover, the Bayesian risk assessment approach serves as a valuable tool in quantifying the potential risks and uncertainties associated with Eely's missions. By assessing and mitigating these risks, the proposed approach contributes to increasing the overall reliability and safety of Eely's operations in demanding underwater environments.

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