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Research Article

VECTOR FIELD PATH FOLLOWING FOR AN AUTONOMOUS UNDERWATER VEHICLE†

P. JANTAPREMJIT*
Department of Mechanical Engineering, Faculty of Engineering, Burapha University, Chonburi, 20131

ABSTRACT:
The paper presents a method of path following guidance for an autonomous underwater vehicle, which is one of the three fundamental problems in the autonomous system. The line of sight guidance based on the vector field is proposed to generate desired path input to the control laws. The proposed optimal path gives a smooth command transition. The concept of this method is developed by a linear quadratic regulator. The candidate Lyapunov function is then used to show asymptotic decay of path following errors. The simulations have shown that the method gives the underwater vehicle to follow the path and converge to the destination with small error in positions and orientations.

Keywords: *Path following; Line of sight; Vector field*

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1. INTRODUCTION

Autonomous underwater vehicles (AUVs) are playing an important role in underwater exploration allowing humans to explore great depths in various new underwater worlds. AUVs are self-contained and are able to have predefined solutions built into their architecture and to take control actions more accurately and reliably without human intervention. Thus, an AUV is an alternative in complex underwater operations. Examples of such operations are seabed mapping and surveying, studying underwater environment and disasters, underwater inspections and constructions, and under-ice explorations [1]. In marine applications, they are considerable interest in the development of advanced methods for marine control system. Motion control is concentrated into three problems, namely stabilisation, trajectory tracking and path following. Stabilisation refers to stabilising a vehicle at a point in the output space. Trajectory tracking aims to make a vehicle track a desired time-parameterised reference trajectory in the output space. Path following is to make a vehicle converge to and follow a desired spatial path in the output space, without any temporal specification. In this paper, path-following and tracking problem is discussed. Generally speaking for the guidance-control problem, it is usually approached as two separate tasks. The first task denoted the kinematic or path following, is to reach and follow a desired trajectory. In the second task, it is to satisfy dynamic behavior along the path, for example a desired speed. This task is usually specified as an assignment for the speed. It is useful in the development of an approach for steering an AUV along the predefined trajectory with a desired speed for accurate path [2].

In [3], the proposed technique has implicit motion planning in which the trajectory and the control action are not explicitly computed before the motion occurs. One of the examples is a potential field algorithm. This method was developed to specify the robot interaction with the environment and how it responds to the sensory information. It comes to the attention because of its simplicity and less computation.

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* Corresponding author: P. Jantapremjit
E-mail address: pakpong@buu.ac.th