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Design of Robot fish by using results of experimental studies of live fish for inspection and maintenance of pipelines on the seabed

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Abstract

This paper presents characteristics of Trout caudal fin and body wave motion quantitatively. These parameters are concerned with design of an improved kinematic propulsive robot fish morphologically. In steady swimming mode, Swimming speed of crangiform fish adjusted by three parameters: oscillating frequency, amplitude and the length of oscillatory part. Its orientation is tuned by different joint's deflections. In order to determine the appropriate mechanism, experimental studies on trout swimming are fulfilled with DPIV[1] and image processing methods and optimal equations of motion are empirically derived. The oscillating amplitude increases dramatically from 1/3 of body and is very small near the head. So the second order function which describes wave amplitude of Trout undulatory movement equation was found and the oscillatory motion of the robot fish with artificial body will be designed according to this equation. In this method within an aquarium using a high speed digital camera (Cube 3) up to 128000 fps and a 4000mW laser source, imaging the mechanism of swimming is performed and using image processing code to find experimentally the optimal coefficients of the motion equation, appropriate location of joints and so on.

Introduction

In nature, fish propels by the undulatory motion of its body and has gained this wonderful swimming ability from thousand years of evolution. Tuna swims with high speed and efficiency, Pike accelerates in a flash and Eel can swim skillfully into narrow holes. As a first step, human observe all of them and according to mechanics appearance, there are questions; which one is better as a swimmer? Or which one is more efficient than a propeller driven under water vehicle?

The underwater robots are an integral part of industrial and marine sciences and application of these systems due to their superiority in comparison with the diving in deep water and hazardous environments has increased.

ROV and AUV robots do not have sufficient efficiency and accuracy required in many engineering and environmental applications and they will disturb the natural conditions of environment so design of a biomimetic robot fish with virtue of high speed, tremendous propulsive efficiency and high maneuverability based on the mechanism and anatomy of crangiform fish with minimum energy consumption is considered [1]. This robot can be used in optimal inspection and maintenance of the seabed pipelines with minimum risk of hazard and cost.

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[1] *Digital Particle Image Velocimetry*