Buoyancy Effect Control in Multi Legged Robot Locomotion on Seabed using Integrated Impedance-Fuzzy Logic Approach

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ABSTRACT

Buoyance forces are part of the fundamental physical resistances that act on moving or swimming objects in the ocean environment. For the case of multi-legged robot, such as hexapod walking on the seabed, buoyance affects the horizontal stability if the motion of the robot's foot does not have sufficient force to step on the bottom of the seabed. Therefore, this study is carried out by integrating a derived Center of Mass (CoM)-based impedance control with fuzzy logic control to cater for the dynamic state that blended with underwater buoyance forces on the motion of the hexapod's foot. This integrated control strategy is designed, modeled and verified on the real-time based 4-degree of freedom (DoF) leg configuration of a hexapod robot model with buoyancy force model as force disturbances. The scope of analysis is focused on verifying the stiffness of undersea bottom soil with the tripod walking pattern, the vertical foot motion of the leg, and the body mass coordination movement during locomotion period..

KEYWORDS: CoM-based impedance model; fuzzy logic control, force restoration; foot motion

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