PD-FLC with Admittance Control for Hexapod Robot's Leg Positioning on Seabed

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ABSTRACT
This paper presents a proposed Proportional and Derivative (PD)-like Fuzzy Logic Control (FLC) (PD-FLC) on dynamic control for vertical positioning of Hexapod Robot walking on seabed environment. The study has been carried out by modelling the buoyancy force following the restoration force to achieve the drowning level according to Archimedes' principle. The restoration force need to be positive in order to ensure robot locomotion is not affected by buoyancy factor. As a solution to control this force, PD-FLC is used and integrated with admittance control that is based on the total force acting on foot placement by considering Center of Mass (CoM) of the robot during walking period. The integrated control technique is verified on a real-time based 4 degree of freedom (DoF) leg configuration of hexapod robot model. The scope of analysis is focused on walking on the varying stiffness of undersea bottom soil with tripod walking pattern. Moreover, the verification is done on the vertical foot motion of the leg and the body mass coordination movement during walking period. The results show that the proposed PD-FLC admittance control is able to cater the force restoration factor by making the vertical force on each foot sufficiently big (sufficient foot placement) compared to the buoyancy force of the ocean, thus resulting in stable tripod walking on the seabed with uncertain stiffness.

KEYWORDS: PD-like FLC; CoM-based impedance model; force restoration; foot motion

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