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CONTACT FORCES OPTIMIZATION OF A BIO-INSPIRED CLIMBING ROBOT FOR SPACE APPLICATIONS

Abstract

Control torques applied at the climbing robot joints can be optimized in order to minimize the strength of the synthetic dry adhesives that are used to keep the robot attached to an inclined surface. Optimal torques are computed by using MiniMax and Least Squares optimization approaches. This paper focuses on a preliminary investigation intended to identify the convenient control torques that the joint actuators of a Legged Climbing Robot (LCR) should exert, in order to improve its stability and take full advantage of the adhesive contact properties. The results obtained are compared to a natural reference condition in which all the joints are unloaded, by placing the robot in an overconstrained static configuration. An experimental setup is designed in order to test the control concepts and validate the simulation campaign. Results show that the use of optimal torques could be highly desirable as the maximum pulling force exerted at the contact tips is drastically reduced, enhancing the stability margin of the climbing robot configuration.