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MACHINE LEARNING FOR PATH PLANNING OF SPACE ROBOTS RVD/B ORBITAL OPERATIONS

Abstract

Abstract This paper approaches the spacecraft-like robot manipulator in an orbital operation during the close approach phase of a cooperative target. The study assumes that the orbit and control subsystem of the spacecraft involves a propulsion actuator system for orbit transfer and adjustments in the close approach of the target. In addition, the spacecraft contains a reaction wheels system for attitude control to synchronize the relative attitude motion between the spacecraft and the target.The article presents a physics informed machine-learning strategy, an approach of AI, to compute the inverse kinematics. The solution of the RVD/B problem considers the interaction effects on the system dynamics, caused by the coupled motion of manipulator joints with orbital motion during the capture operation. It is enhanced the unbalancing problem caused by the shift of system CoM during robot arm motion toward of the target's docking port or toward the grasping point on the target. The computer simulation outputs allows for the analysis of the Propulsion maneuvers and reaction wheels control effectiveness cost problem. The article addresses a discussion of the performance methodology related to the amount of historical data increases. In addition, the results allow for a conclusion that in some cases the machine-learning algorithm is able to calculate the inverse kinematics with great precision. In general, its use results in a significant improvement onthe process convergence. Keywords: support vector machine, inverse kinematics, uncertainty uncertainty quantification, RVD/B, space robotics