World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:13, No:02, 2019

Path-Tracking Controller for Tracked Mobile Robot on Rough Terrain

Authors : Toshifumi Hiramatsu, Satoshi Morita, Manuel Pencelli, Marta Niccolini, Matteo Ragaglia, Alfredo Argiolas

Abstract : Automation technologies for agriculture field are needed to promote labor-saving. One of the most relevant problems in automated agriculture is represented by controlling the robot along a predetermined path in presence of rough terrain or incline ground. Unfortunately, disturbances originating from interaction with the ground, such as slipping, make it quite difficult to achieve the required accuracy. In general, it is required to move within 5-10 cm accuracy with respect to the predetermined path. Moreover, lateral velocity caused by gravity on the incline field also affects slipping. In this paper, a path-tracking controller for tracked mobile robots moving on rough terrains of incline field such as vineyard is presented. The controller is composed of a disturbance observer and an adaptive controller based on the kinematic model of the robot. The disturbance observer measures the difference between the measured and the reference yaw rate and linear velocity in order to estimate slip. Then, the adaptive controller adapts “virtual” parameter of the kinematics model: Instantaneous Centers of Rotation (ICRs). Finally, target angular velocity reference is computed according to the adapted parameter. This solution allows estimating the effects of slip without making the model too complex. Finally, the effectiveness of the proposed solution is tested in a simulation environment.

Keywords : the agricultural robot, autonomous control, path-tracking control, tracked mobile robot
Conference Title : ICFSR 2019 : International Conference on Field and Service Robotics
Conference Location : Barcelona, Spain
Conference Dates : February 11-12, 2019