Eric H K FUNG et al., Adv Robot Autom 2015, 4:2
http://dx.doi.org/10.4172/2168-9695.S1.002

OMICS International
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World Congress on
Industrial Automation

July 20-22, 2015 San Francisco, USA

3D Simulation of Human-like Walking and Stability Analysis for Bipedal Robot with Distributed Sole Force Sensors

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This paper presents a 3D simulation method in SimMechanics for a floating type robot, known as bipedal robot. According to the physical experimental bipedal robot built in our laboratory, a 3D model using the same physical parameters is developed in SolidWorks, which serves as a platform to be simulated and analyzed in Matlab. By performing the simulation, we can verify the methodologies to be applied, and test the robot kinematic and dynamic characteristics before the physical robot experiments are carried out, aiming at revealing the possible problems beforehand. Secondly, a ground contact model between soles and the ground and a model of distributed sole force sensors are introduced for the purpose of ZMP (zero moment point) calculation. By modeling the distributed force sensor system attached to the bipedal robot feet, precise pressure profiles in different walking phases can be obtained during simulation. ZMP, the point at which the total horizontal inertia on the robot body equals to zero, is used for stability analysis. Finally, by applying the models and methods described above, a human-like straight line walking pattern is chosen for stability analysis by applying ZMP criteria. Simulation results demonstrate that this 3D simulation method with distributed sole force sensor model is effective in analyzing the walking behavior of the bipedal robot. For the given walking pattern, the bipedal robot in the simulation environment can walk stably satisfying all the constraints of the physical robot.

Biography

Eric FUNG has completed PhD from University of Hong Kong, and now working as a visiting Associate Professor in Department of Mechanical Engineering of The Hong Kong Polytechnic University. He has over 20 years of experience in control application, robotics and automation. He is the author and co-author of over 100 papers in journals and conference proceedings.

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