Modeling and Control of a Hybrid Wheeled Legged Robot: Disturbance Analysis

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Abstract
The most common cause of injuries among older adults is falling. Recently, there have been numerous developments in assistive and exoskeleton systems. However, comparatively little work is being done on systems that may help people to keep an upright position and avoid falling over. In this preliminary work, we investigate the feasibility of the wheel-legged robot as a balance-assist system for the people who cannot maintain balance and walk because of an injury, old age, or neurological or physical disorder. We perform motion stability analyses of the wheel-legged robot under different conditions such as system modeling errors, sensor noise, and external disturbances. The linear quadratic regulator (LQR) control approach is adopted for balancing, steering, and translational position control of the robot. To validate our control framework and visualize results, the robot is modeled and tested in the Gazebo simulator using ROS (Robot Operating System). Subsequently, the simulation results demonstrate the effectiveness of the LQR control method under the translational and rotational pushes of the wheel-legged system for human-robot interaction.

Full-text
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