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Quasi-inverse pendulum model of 12 DoF bipedal walking (Article)

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Abstract

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This paper presents modeling of a 12-degree of freedom (DoF) bipedal robot, focusing on the lower limbs of the system, and trajectory design for walking on straight path. Gait trajectories are designed by modeling of center of mass (CoM) trajectory and swing foot ankle trajectory based on stance foot ankle. The dynamic equations of motion of the bipedal robot are derived by considering the system as a quasi inverted pendulum (QIP) model. The direction and acceleration of CoM movement of the QIP model is determined by the position of CoM relative to the centre of pressure (CoP). To determine heel-contact and toe-off, two custom designed switches are attached with heel and toe positions of each foot. Four force sensitive resistor (FSR) sensors are also placed at the plantar surface to measure pressure that is induced on each foot while walking which leads to the calculation of CoP trajectory. The paper also describes forward kinematic (FK) and inverse kinematic (IK) investigations of the biped model where Denavit-Hartenberg (D-H) representation and Geometric-Trigonometric (G-T) formulation approach are applied. Experiments are carried out to ensure the reliability of the proposed model where the links of the bipedal system follow the best possible trajectories while walking on straight path. © 2017, Institute of Automation, Chinese Academy of Sciences and Springer-Verlag Berlin Heidelberg.

Author keywords

Anthropoid gait Humanoid robot quasi-inverse pendulum trajectory planning

Indexed keywords

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