Introduction to Robotics Course Project Proposal

Project title:

Analysis of dynamics walking for a human-riding biped robot, HUBO FX-1

List of group members:

Tze-Yuan Cheng and Yan Yan

Motivation:

The human-riding robot has become a representative research topic in robotics; it can provide mobility to the physically impaired, be used as a lifesaving robot at the site of an accident or serve as a military combat robot in the army. However, as the biped humanoid robot has drawn increasing interest in the robotics field recently, the practical use of a biped walking robot is still limited due to the difficulty of artificial intelligence and locomotion design. The human-riding biped robot, HUBO FX-1 (Figure 1) does not need a complicate artificial intelligence, as the passenger makes the judgments regarding motion and moves the robot. Also along with a relative simple structure design, this robot can be used as a good course project practice.

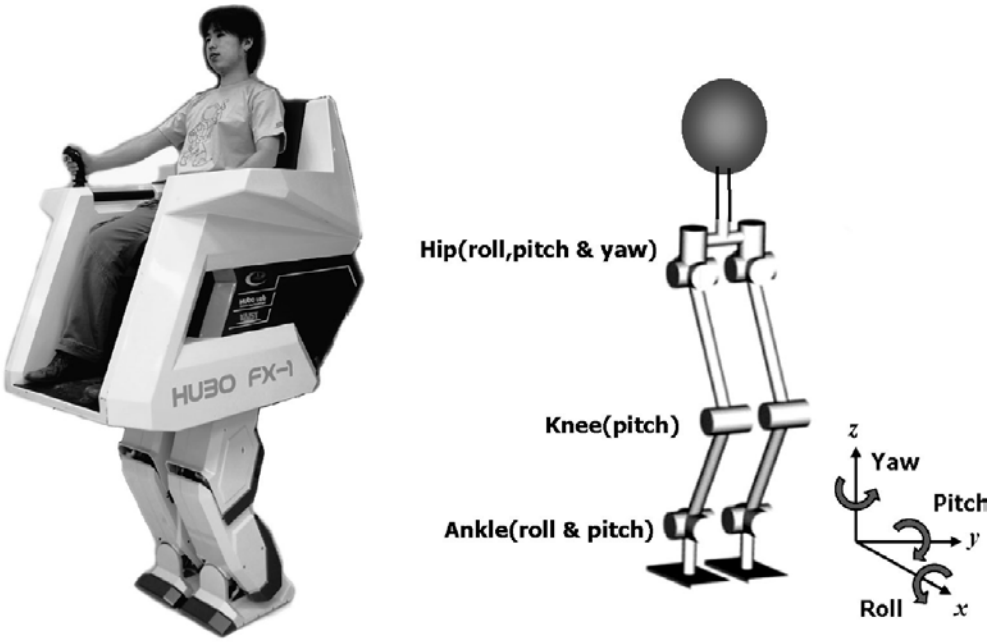

Figure 1. Photograph and joint structure of HUBO FX-1 [1].

Objective:

Analyze the kinematics and dynamics of the simplified HUBO FX-1 model, and design the feedback controller on vibration reduction.

Technical Description:

1. **Kinematics :**
   a. Analysis of Degree of freedom for human-riding biped robot
   b. Analysis of Forward & Inverse Kinematics for two legs during walking
   c. Walking pose simulation
2. **Dynamics:**
   a. Dynamics equations for joint torque of two legs during walking
   b. Analysis of vibration dynamics
3. **Controller Analysis in MATLAB:**
   a. Analysis of model-based vibration reduction controller
   b. Analysis of real-time balance controller (optional)

Project Timeline:

Nov. 11th - Nov. 14th: Paper review & Kinematics analysis

Nov. 15th- Nov. 19th: Analysis of Dynamics & Trajectory simulation using MATLAB

Nov. 20th- Nov. 25th: Analysis of Control using MATLAB

Nov. 26th- Nov. 30th: Project Summary writing & Presentation Preparation

Reference:

[1] Jung-Yup Kim, Jungho Lee And Jun-Ho Oh, Experimental realization of dynamic walking for a human-riding biped robot, HUBO FX-1, *Advanced Robotics*, Vol. 21, No. 3–4, pp. 461–484 (2007)