Institute of FIeld roBOtics (FIBO)

A Cradle of Future Leaders in Robotics

Nonlinear Control of a two-link planar Manipulator

Investigator: Rawichote Chalothorn

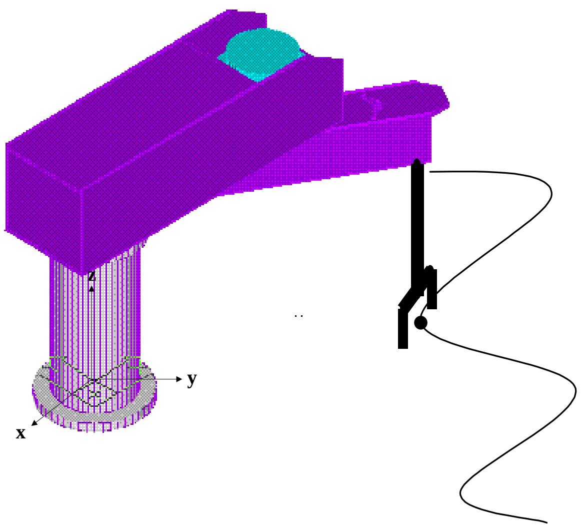
Most commercial robots have relatively simple controllers based on linear control theory. It is important to completely consider nonlinear dynamics of manipulators such that we can achieve higher performance than ones by linear schemes.

Previous robot designs benefit from using gear reduction and operating at modest speeds avoiding nonlinear effect. To achieve faster speed with high accuracy, a current trend of robot design is to use direct drive joints. These joints are directly driven by special high-torque actuators. This elimination of gears and other power transmission mechanisms reduces friction and backlash. Faster robots promote higher thoughput and productivity. Effective nonlinear control requires accurate modeling. Such modeling must include dynamic components for example inertia, Coriolis and friction terms as well as some dynamics coupling terms. Researchers around the world at leading universities are proposing new schemes of nonlinear control for robotic manipulators. As the first robotic center in Thailand, FIBO is also planning to carry out this fundamental research such that it can respond to needs of local industry in the area of advanced controller design, for faster speed, complicated FMS machinery. We have the following research objectives:

1. Develop a highly accurate dynamic model of a two-link planar mechanism. The model will be constructed by using a concept of distributed mass. All nonlinear forces such as centrifugal force, Coriolis force and friction will be included in this model.

2. Design a nonlinear controller for the two-link planar mechanism. This controller will guarantee the global stability of the dynamic model developed in the first objective. This nonlinear controller enables manipulator to move along any trajectory of position or velocity in its working space with a uniform and consistent performance.

3. Build a controller developed in the second objective. The controller will control the manipulator move along any position paths continuously, instead of finite point-to-point as in conventional commercial robots. Experimental will be carried out to verify this theory.



A computer graphic solid model of a direct-drive two-link manipulaton.

Address: Suksawasd 48 Bangmod Bangkok 10140 Thailand
Tel. No. +66 (0) 24709691, 4709339 Fax +66 (0) 24709691 http://fibo.kmutt.ac.th