SIAM ROBOTIC SIMULATOR (SIROS)

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In order to help students to understand the concepts of robot motion and robot programming, the use of laboratory equipments is necessary. However, these equipments are quite expensive and restrictive in function. Thus, the use of simulator is an alternative approach for studying robotics.

In this project, a robotic simulation program named Siam Robotic Simulator (SIROS) was written in Visual C++. This simulator allows users to simulate their robot configurations conveniently. A 3-D graphical library called OpenGL is used to render 3-D geometric models of robotic mechanism through a head mounted display for obtaining realistic images. SIROS also provides an interactive graphical user interface (GUI) running on the Microsoft Windows . Furthermore, this program offers several tutorials about basic concepts of robotics.

Each basic mechanism of robot is represented by the geometric models (e.g., box, cylinder, and sphere) as illustrated in Figure 1. Users can change their viewpoints via a virtual camera or a head mounted display. Hence, their properties, such as shape and size, could be specified easily.
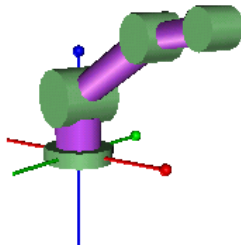

Figure 1 A simulation of 4-DOF robot manipulator

In addition, the user can control dialog box or use a mouse to translate or rotate the simulated mechanisms with an ease. The coordinate at the end-effector can also be determined in real-time.

Besides, SIROS contains a physical simulation part of a moving ball as shown in Figure 2 to illustrate a physical-based simulation. This example is used to demonstrate the behavior of object for obtaining realistic sensation.
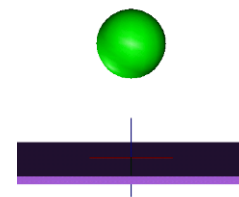

Figure 2 A physical simulation of moving ball

Another objective of SIROS is to provide users some basic tutorials in robotics such as
- basic kinematics i.e., position, orientation, and transformation,
- kinematic manipulators (Denavit-Hartenberg link parameters as shown in Figure 3), and,
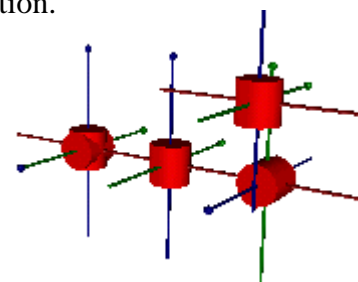- example of closed form dynamics equation.

Figure 3 Denavit-Hartenberg Link parameter

Our future work is to develop this simulator for designing and simulating actual robots for examining their behaviors. Moreover, motion commands can be generated to control robots directly from this simulator.

In conclusion, SIROS provides an inexpensive and safe way for studying and operating of robot manipulators.