Springhead: Open source haptic software for virtual worlds with dynamics simulations

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1 Introduction

We developed an open source haptic software library named Springhead for virtual worlds with dynamics simulations.

Combination of haptic interfaces and dynamics simulations realizes intuitive manipulations and realistic virtual worlds. It is useful for many applications such as virtual prototyping, educations, and entertainments. Many force display devices and dynamics simulators has been developed. Few systems, however, employ both dynamics simulations and haptic interfaces. Haptic interfaces require very fast update rate for control. Integrations of haptic interfaces to dynamics simulators for computer graphics are not easy. Therefore, we developed a dynamics simulator for haptic update rate.

We believe there are many applications and we hope to spread this technology as soon as possible. We decided to provide it as an open source haptic software for virtual worlds with dynamics simulations.

2 Features of Springhead

The software library named Springhead has following features.

Dynamics simulator We developed a contact force solver, which consider intersection volume of virtual objects [1]. The solver finds accurate normal and friction forces. On the other hand, simulations of joints require high rigidity and are difficult for penalty-based simulators. We implemented Featherstone's method [2], which realizes rigid joints.

Haptic renderer The contact force solver is also used for haptic rendering. Any virtual object with various shapes can be used for haptic pointers.

File input/output Springhead uses VRML or DirectX format (by user's choice) to store models for virtual worlds. The library has file loader and saver based on the idea of document object model [3].

Device abstraction We employ object oriented and generic programming technique to describe human interface devices. Users can inherit existing class for their device and use many algorithms provided by Springhead.

Haptic interface support The library has device drivers for haptic interface of SPIDAR [4] and PHANToM and virtual haptic device via mouse [5].

3 Demonstrations

We will bring some string-based haptic interfaces named SPIDAR and demonstrate the features of the software. Fig.1 shows pictures of demonstrations. We put all source codes on our web page[6]. Please visit and try.
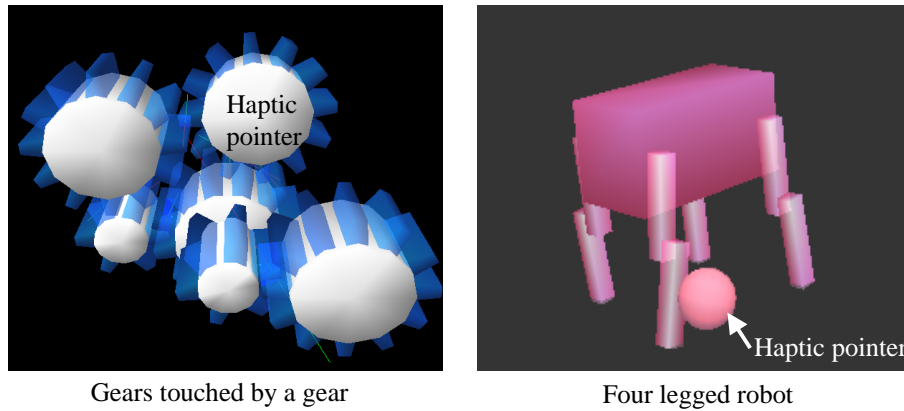

Gears touched by a gear   Four legged robot

Fig. 1. Two pictures from the demonstrations

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