

Introduction to haptics



CS 223A
AI / ROBOTICS Lab
Stanford University

François Conti

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outline

- what is haptics ?
- current force feedback devices
- tactile rendering algorithms
- applications in the field of haptics
- demonstrations

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definition | according to Webster

main entry: *hap-tic*
pronunciation: **hap-tik*
function: adjective
etymology: international scientific vocabulary,
from Greek *haptesthai* to touch

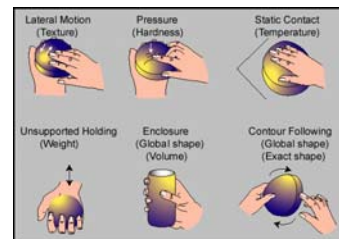
date: circa 1890

- 1 : relating to or based on the sense of touch
- 2 : characterized by a predilection for the sense of touch <a haptic person>

Merriam-Webster, Incorporated, <http://www.m-w.com/cgi-bin/dictionary>

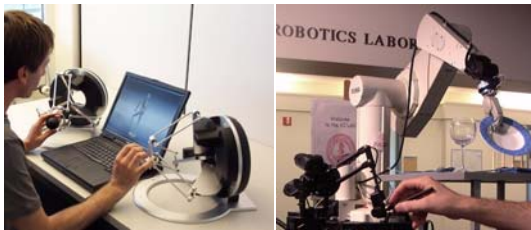
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the sense of touch



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goals



Omega / Force Dimension

PHANTOM / Sensable Technologies

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outline

- what is haptics ?
- **current force feedback devices**
- tactile rendering algorithms
- applications in the field of haptics
- demonstrations

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haptic devices – ultimate workstations



IMMERSION

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haptic devices – golf trainer



GRADENER AND SASCH ORLIC, PGA GOLF PROFESSIONAL

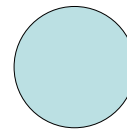
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haptic rendering



virtual object
(sphere)

- no contacts
- no reaction forces

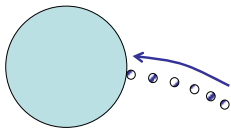


cursor
(3 dof)

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haptic rendering

- move cursor towards surface

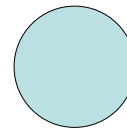


virtual object
(sphere)

cursor
(3 dof)

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haptic rendering



virtual object
(sphere)

cursor
(3 dof)

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haptic rendering

- collision detected

virtual object (sphere) cursor (3 dof)

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haptic rendering

- reaction force computed
- force magnitude ?

virtual object (sphere) cursor (3 dof)

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haptic rendering

- spring model
- $F = k_s d$

virtual object (sphere) cursor (3 dof)

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haptic rendering

virtual object (sphere)

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haptic rendering

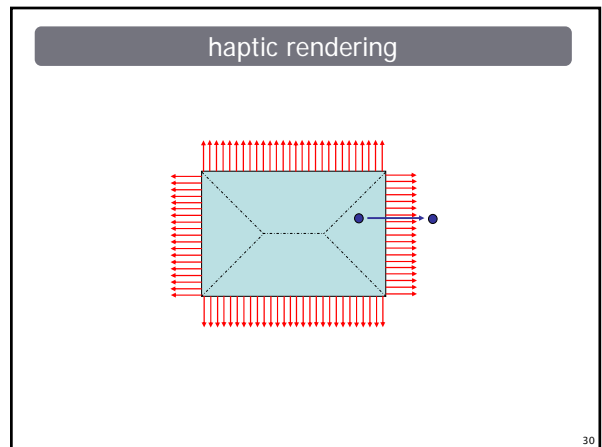
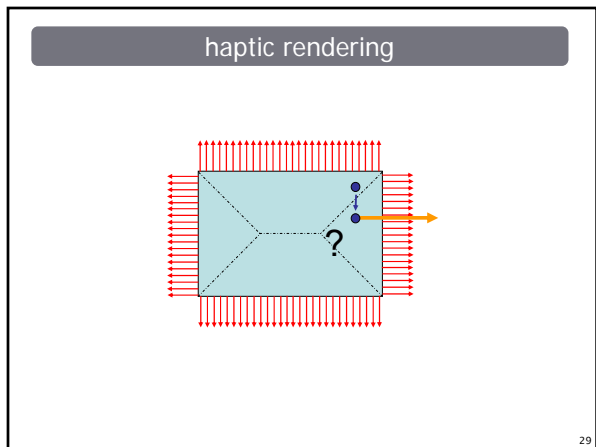
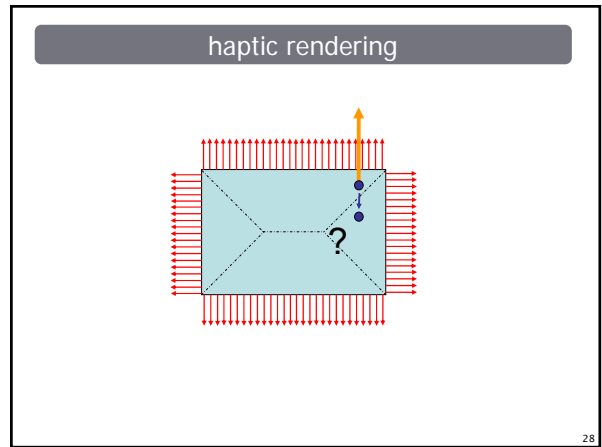
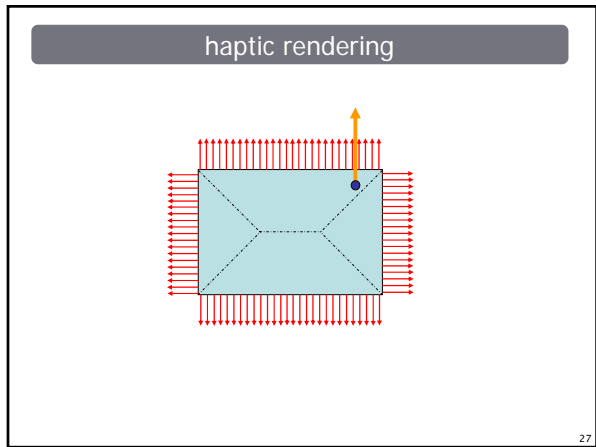
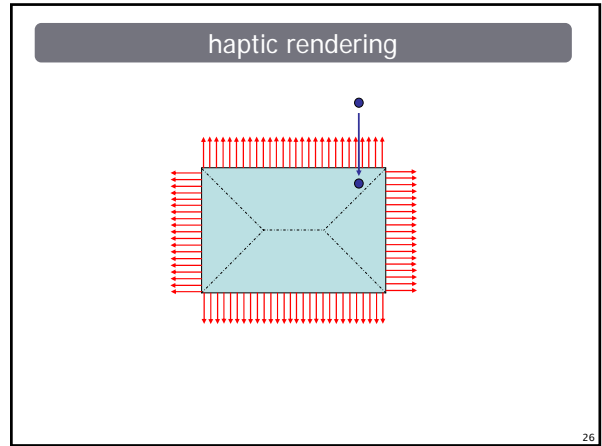
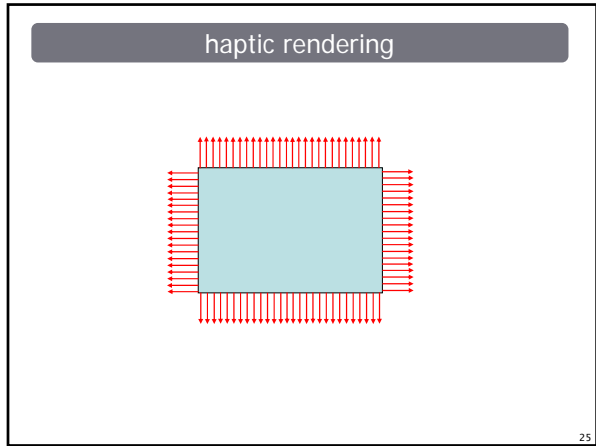
virtual object cursor

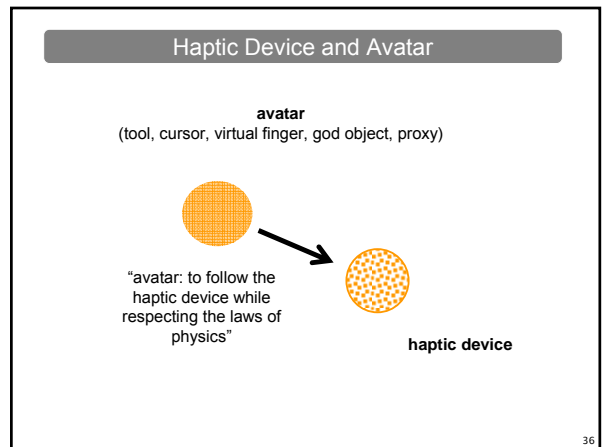
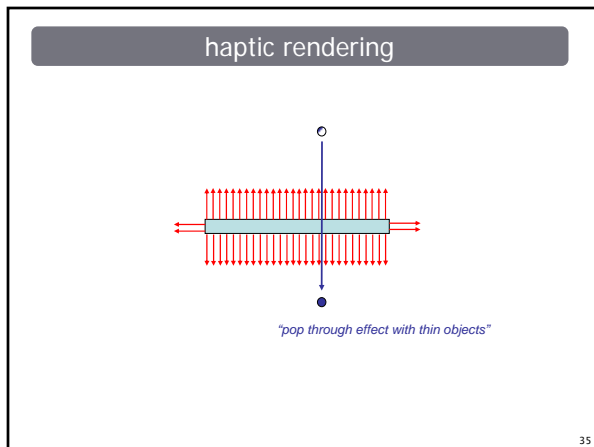
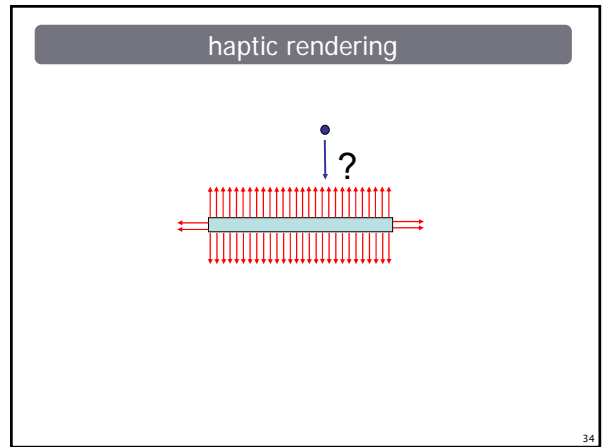
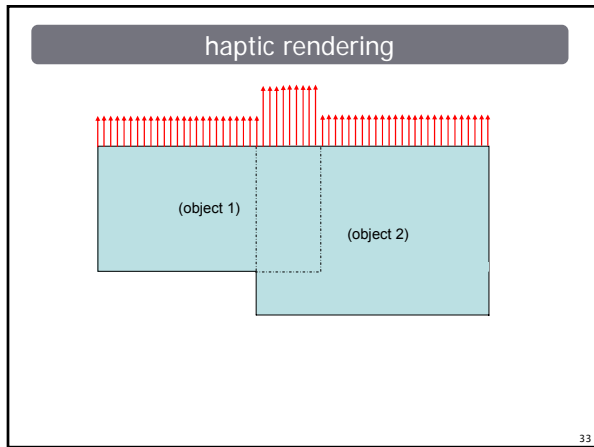
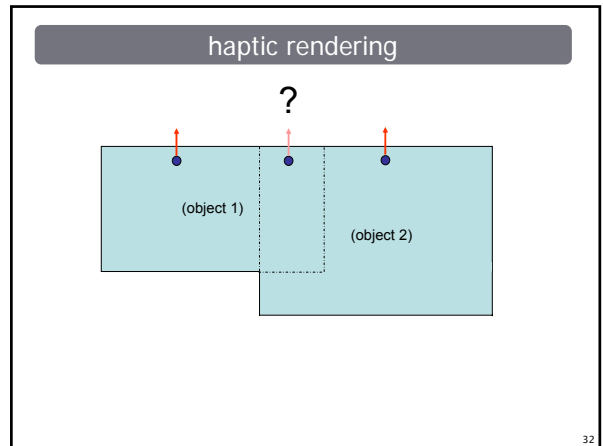
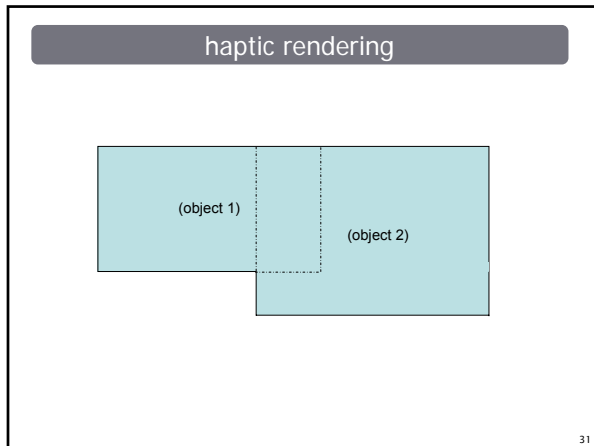
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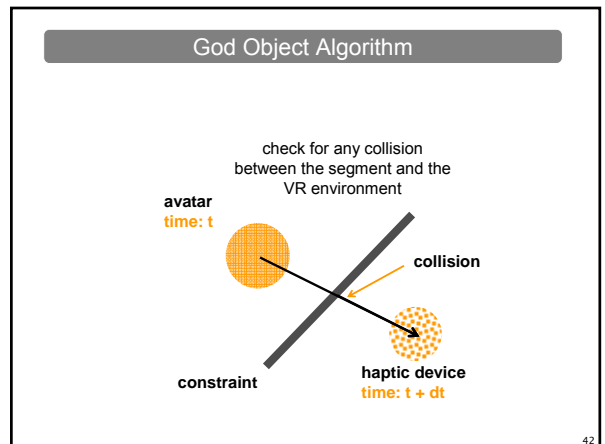
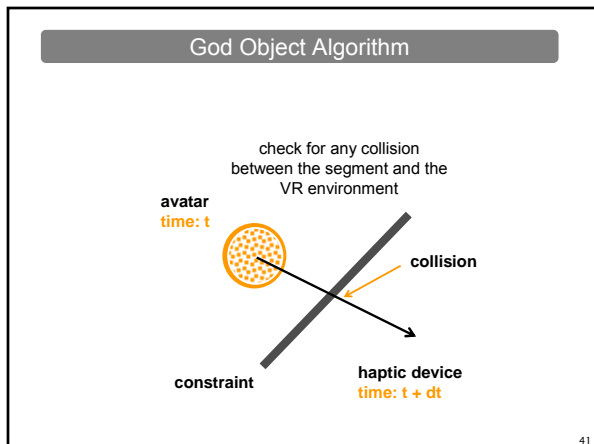
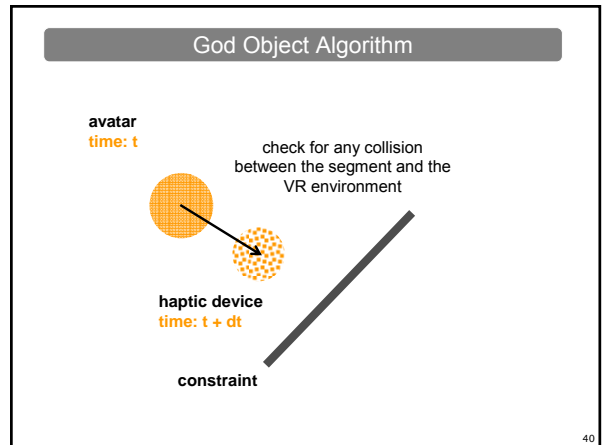
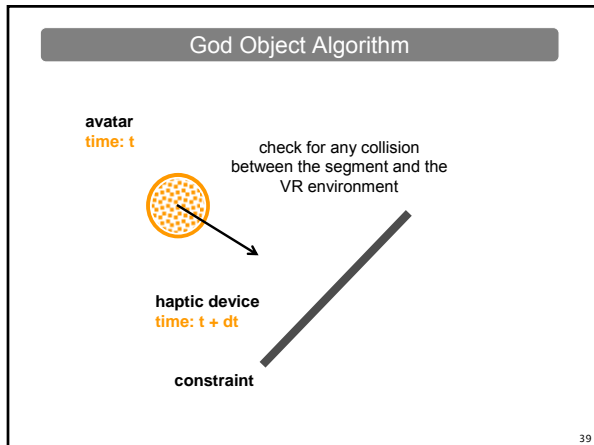
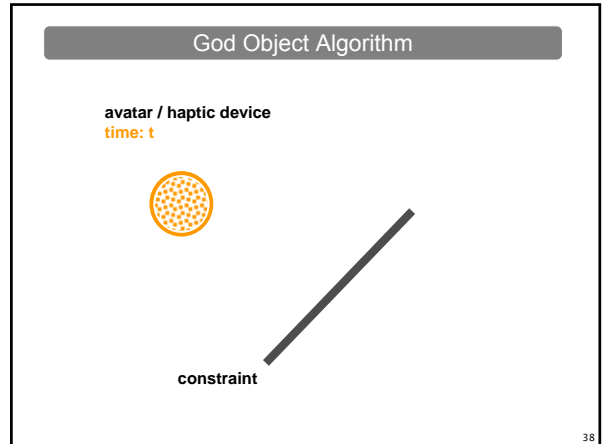
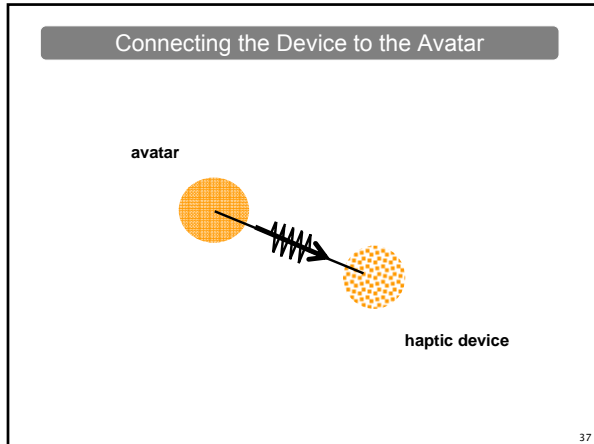
haptic rendering

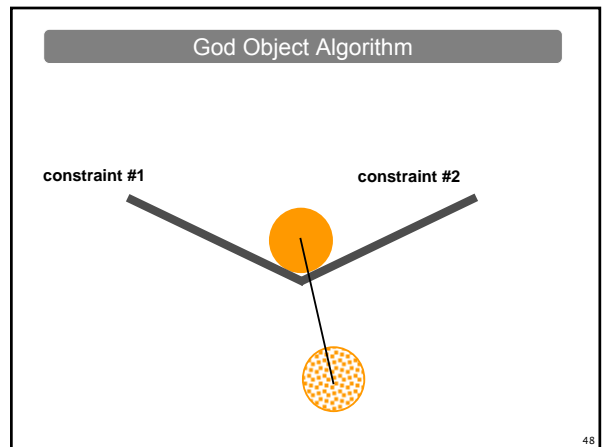
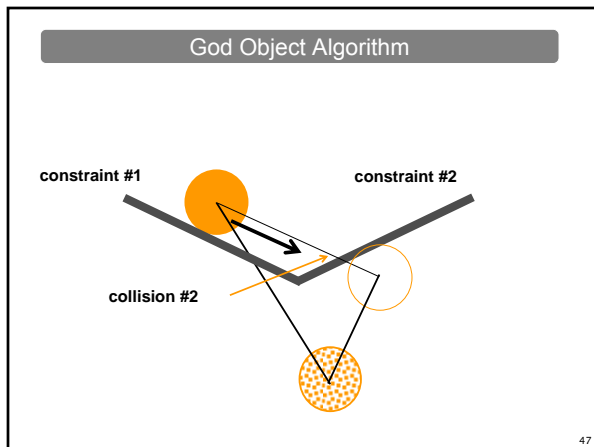
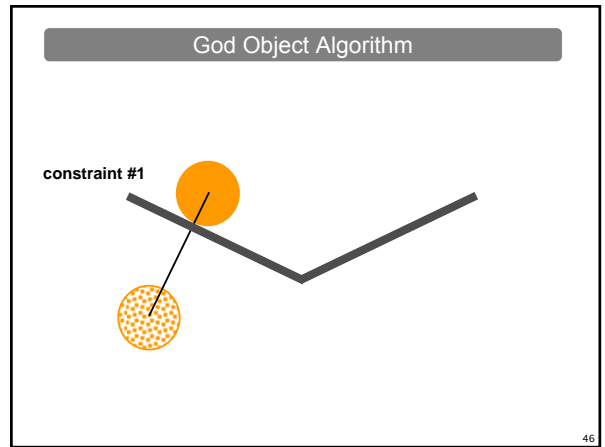
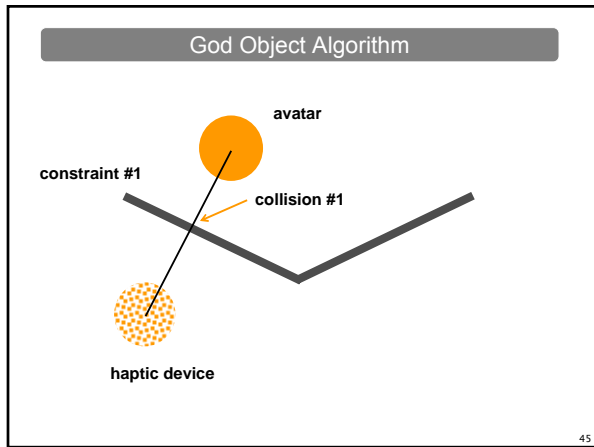
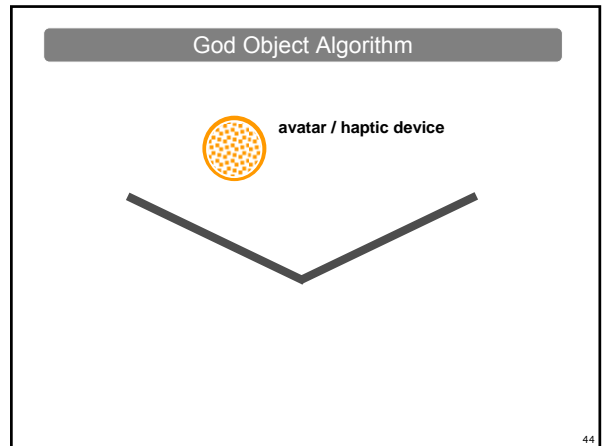
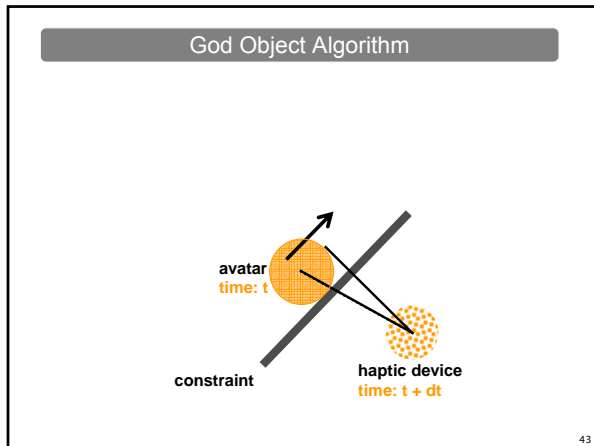
virtual object cursor

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God Object Algorithm

avatar

collision #3 haptic device

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Computing the Reaction Force

avatar

haptic device

$F = -k \cdot \text{material} \cdot x$

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Finger – Proxy Algorithm

● PHYSICAL POSITION ● PROXY POSITION

constraint plane

Configuration Space Obstacle

The Haptic Display of Complex Graphical Environments
D. Ruspini, K. Kolarov and O. Khatib

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demonstration

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Experimental haptics

CS 277 - Experimental Haptics
Stanford University, Winter 2009-2010

Experimental haptics introduces the essential topics of haptic engineering and touch feedback in virtual reality. The objective is to provide students with the skills necessary to understand and design real-time virtual reality haptic simulators and applications.

The course relies on *Function and Form* by D. H. S. Lee and G. S. Lee.

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Experimental haptics

final project demo

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Haptic Manipulation



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Medical Field



PHILIPS MEDICAL

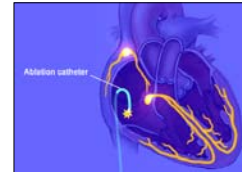
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Medical Field

medical control interface

radiofrequency catheter ablation

- l stroke risk increased by atrial fibrillation
stroke is 3rd leading cause of death in the US
- l heart beat disorders
arrhythmia, tachycardia
potentially dangerous
- l carefully destroy abnormal areas
ablation catheter delivers RF energy
- l minimal invasive procedure
requires high precision and reliability



hansen
MEDICAL

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medical field



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