Medical Imaging
Image Generator to Support the Application of a Haptic Device for the Simulation of Arthroscopic Surgery

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Project Introduction

- Magnetic Resonance Imaging (MRI)
- MRI show cross section knee
- Create 3-D model of cartilage
- Simulate surgeon’s view during arthroscopic surgery
- Simulate the arthroscopic surgery with a haptic feedback system

MRI Scan of Knee

Picture Provided By Dr. Stewart
Project Introduction

- Not Diagnosis Tool
- Medical Students
- Current medical simulator enables demonstration and trial of insertion of torqueable elongated members (guide wires or catheters) into small body passages
System Block Diagram

Image Data from MRI 500X500 Pixels → MATLAB CODE to Generate Model of Cartilage and Simulation of Arthroscopic Surgery → Arthroscopic Surgery Simulation on Monitor
Software Block Diagrams

- Image Processing Block Diagram
- Graphics Block Diagram
Image Processing Block Diagram

- Creates model of cartilage
  - Isosurfaces-displays overall structure of cartilage
  - Isocaps-reveal details of interior cartilage
Graphics Block Diagram

- Takes the model of cartilage and creates the simulation of an arthroscopic meniscus surgery
Actual Views of Arthroscopic Knee Surgery

Figure 1: Arthroscopic Surgery View of Torn Cartilage

Figure 2: Arthroscopic Surgery View of Healthy Cartilage
Preliminary Results / Issues

- Model of Cartilage
- Lighting
- View Control

- Making the MRI data model look like an arthroscopic surgeon’s view
Model of Cartilage
Lighting

- Cone Model
- Cone with Light
View Control

- Matlab Functions
  - Camera position
  - Camera target
- Views from different angles and at different locations
- Limited - cartilage is not yet split
Simulation of Surgeon’s View

- Light added to Cartilage Model

- Problems
  - Model blows up the size of the cartilage on the screen
  - Lack of data causes distortion to show on the cartilage when light is added

- Proposed Solution
  - Render data between two points
  - Two dimensional filter over a curve
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Equipment List

- PC with Matlab Version 7.0.1
- SensAble Phantom Omni Haptic Device
Project Summary

- Project Introduction
- System Block Diagrams
- Software Block Diagrams
- Preliminary Results / Issues
- Schedule
- Equipment List
Questions?