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Applications of Haptic Technology in Engineering Education

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Introduction

Background – Haptic Technology

- The word haptics is derived from the Greek word haptikos, meaning "related to the sense of touch".
- Provides more “top-down” (big-picture) learning perspective [1]
- The study of haptic technology integrates neuroscience, psychology, robotics, and virtual reality to accomplish two goals:
  (1) Understanding how humans perceive and use touch sensations
  (2) Creating touch sensations using mechatronic systems [2,3]

Project Goals

- We have been studying how haptic technology can be used to improve intuition and retention of engineering concepts.
- Our preliminary study has shown promising results, but there are still areas of potential improvement.

Results

The new virtual environment (compared in Figure 3) seeks to integrate the concepts of friction and slipping/tipping better than the previous version. To achieve this, the following changes were made:

- Slip and tip inequalities were added to explain the block’s behavior
- Instructions were added to guide the student’s interactions
- The coefficient of static friction ($\mu_s$) was rescaled to 0-1 to better reflect life-life values
- Bumpers were added to prevent the block from getting stuck

Future Work

- Implement this model in a classroom environment
- Construct a sturdier design for the Haply robot (Figure 4)
- Continue to explore a variety of engineering computational problems where haptic feedback would be beneficial

References