Presentation

My name is Zohar Franco and I will talk about Robotics in-hand control by vibrations.

The research I joined is led by Noam Nahum and is part of the robotics lab run by Dr. Avishai Sintov. The research is about the robotics subjects of grasping objects and performing in-hand manipulations. The ability to manipulate the object inside the robotic hand has many uses in variety of industries. But today, most of the solutions are complex and sophisticated, multi-part hands at high prices. In the study we search for a way to enable in-hand manipulations using a simple robotic hand.

The unique solution - with a vibration motor and simple hand, the robot creates vibrations in order to move the object. Vibrations affect the object's movement. Control of the vibrations allows manipulation of object position inside the hand. In the study we Use finger vibrations for credit card repositioning. The goal is to provide the ability of in-hand control of different objects using an inexpensive hand. It will reduce the costs of using in-hand technologies. This will enable the use of this ability in new areas.

One of the needs of the study was to find the finger curve according to the motor vibration force. We should know the influence on the finger curve at any moment in order to control the object and to perform in-hand manipulations. The task was divided into stages; First step was to find the static connection - the finger curve while constant force is applied. Then find the finger curve in a dynamic state when the force isn't constant and there are vibrations. This is actually the real situation that needs to be investigated.

During the first semester of the past year, I studied the solid mechanics course, which includes the small deformations theory. In a situation where the deformations are small in proportion to the object's size, and a constant force is applied the theory provides a way to calculate the curve of a beam. Because of the finger shape, we could model it as a beam for analyzing its curve while using the theory.

I wrote a program that represents a finger as a complex beam. The user can create - beams with different cross sections and different materials. The program also provides basic functionality to find attributes as volume, length, as well as moment of inertia of the different sections, moment along the beam and more. Finally it can calculate the curve of the finger when constant force is applied and the state is static using the theory of small deformations.

The force that's really activated on the beam is vibrations, time dependent force. In this state of vibrations we can't find the curve by finding the static state at each point of time. In vibrations dynamics the behavior changes completely. In this situation the curve can be analyzed using vibrations theories.

I started to add the time dependent element for the program. The beam can be in a dynamic state which means that the applied force, the moment, the sheer force and so on are time dependent. Until now, I have not developed the program to calculate the curve of the finger in this state of vibrations. I need to study the vibration theory in depth as well as to be proficient in the subject of partial differential equations

which is important tool in vibrations theories. Then continue the program in order to find the time dependent curve.

Thank you