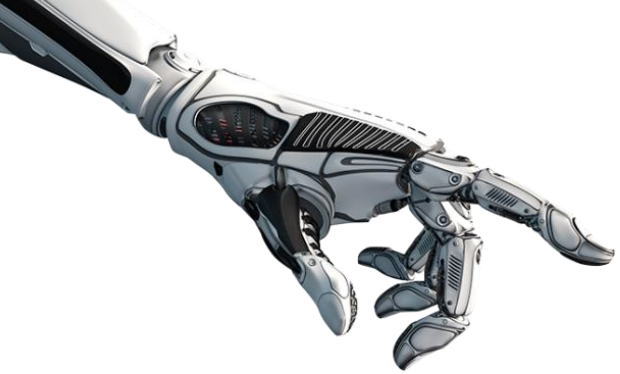


Robotics in-hand control by vibrations

Zohar Franco

The research

- The study is led by Noam Nahum
- Robotics laboratory - Dr. Avishai Sintov.
- In-hand manipulations is a field in robotics. It has many uses in variety of industries.
- Today, most of the solutions are complex and sophisticated hands at high prices.
- Way to enable in-hand manipulations using a simple hand.

The research solution

- Vibration motor and simple hand.
- Robotics vibrations - allows in-hand control.
- Use finger vibrations for credit card repositioning.
- Ability of in-hand control of different objects using an inexpensive hand.
- Reduces costs of using the ability – use in new areas.

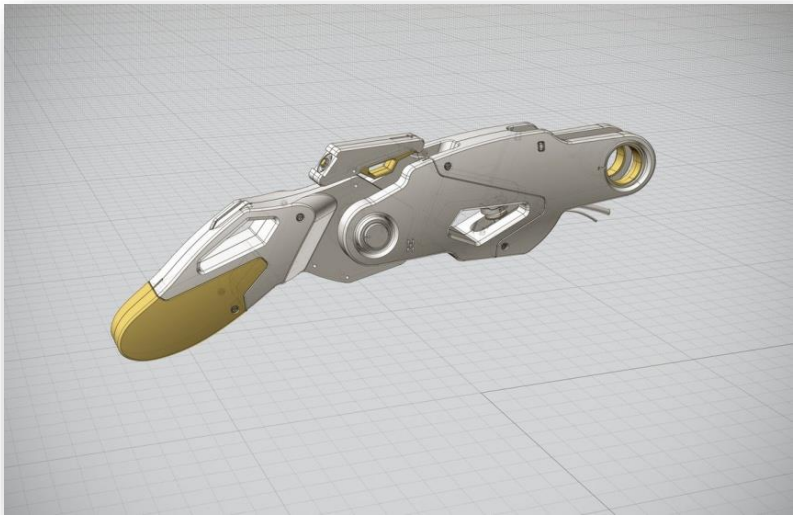
Need for research

There was a need to find the curve of the finger.

The motor activates vibrations that affect the curve of the finger.

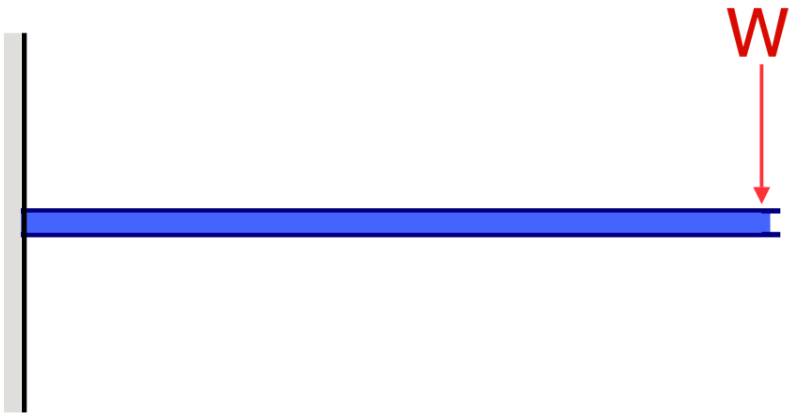
In order to control the in-hand manipulations, the curve must be known and analyzed.

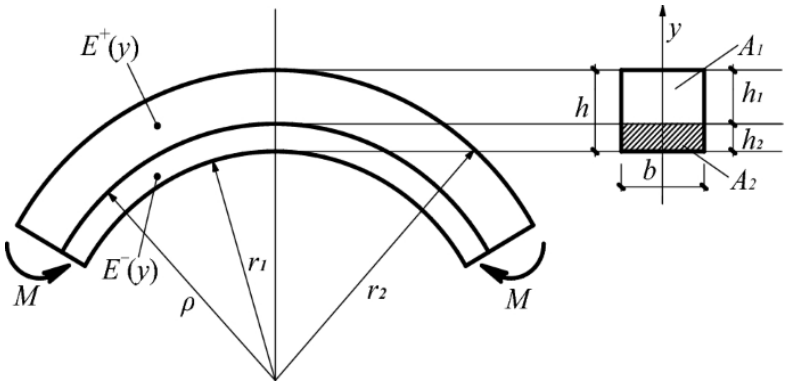
- static state - constant force.
- state of oscillation - curve depends on time.



Bending beams

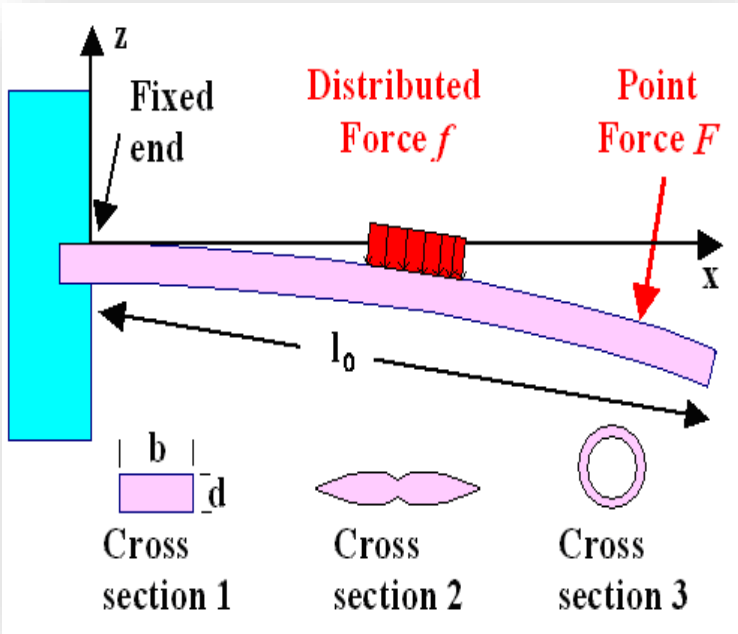
- The Course ‘Solid Mechanics’.
- The theory of small deformations and deflections.
- Model the finger as a harness beam.
- Calculating the curvature of the finger according to the theory.





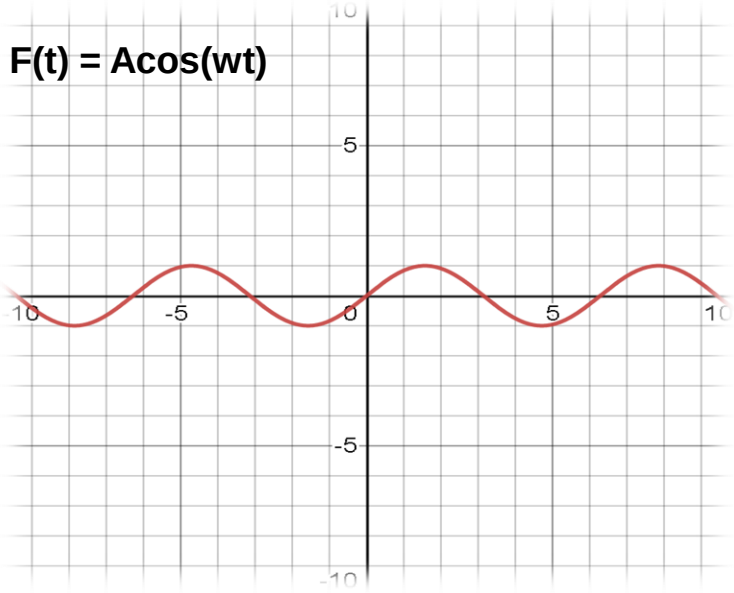
My work

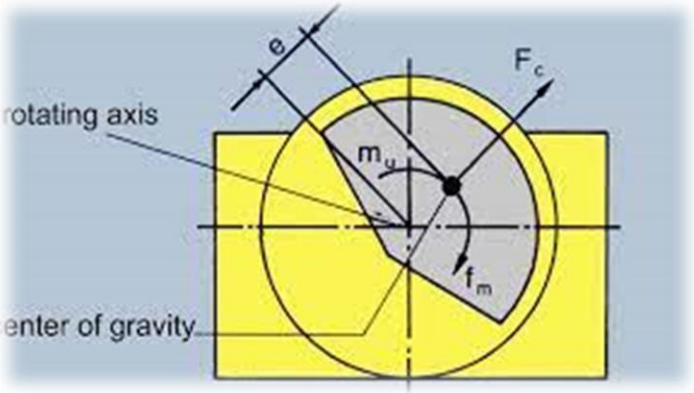
- Python program to represent a finger as a complex beam
- Beam is made of different materials with different cross sections.
- Calculates different attributes in static state.
- Calculates finger curve in static state.



Vibrations

- The real force acting on the finger is sinusoidal force.
- The behavior of the object changes completely.
- The beam curve should be analyzed using the theory of oscillations.

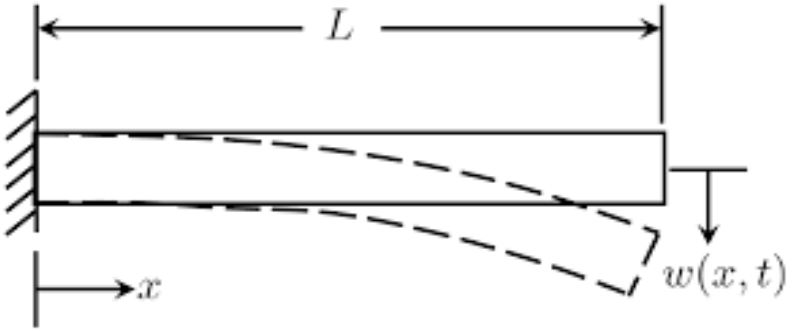




Future

- I continued the program and built its foundation to adapt to the existing situation and address time-dependent force.
- Until now the program can’t calculate the finger curve in vibrations dynamics.

- I have to study vibrations theory in depth and then continue the program to find the vibrations curve.



$$-\left[EI(x)\ w''\right]'' = \rho A(x)\ \ddot{w}$$

Thank you