Mechanics and machines

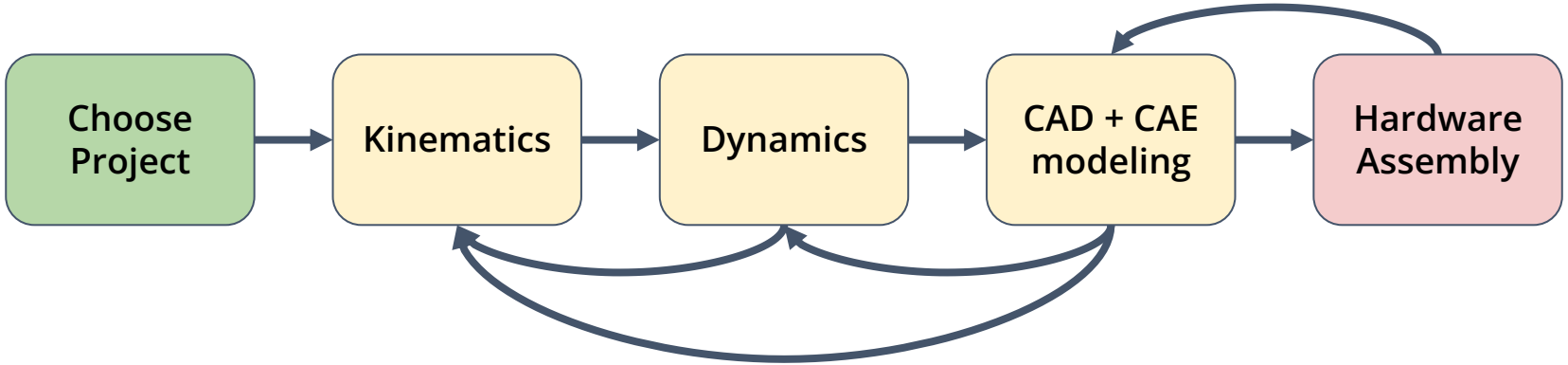
Project

Innopolis University

Possible projects

PDF in Moodle

Workflow


Choose Project
Kinematics
Dynamics
CAD + CAE modeling
Hardware Assembly

Best projects will be published

It is the reason why do you need to write reports nicely

Example: paper
(recommend to get acquainted)

Project description

Goal: to present the chosen 1 DoF mechanism in hardware due to the end of the course and provide kinematics, dynamics, CAD, CAE analysis for the mechanism. Each step should be reported in appropriate time.

Provided hardware:

1. 1 motor Pololu 75:1 Metal gear motor 25x54L mm HP 12V (more info in Moodle)
2. 3D printer
3. We are helping with finding screws, bearings, etc

Mechanism constraints:

1. Motor cannot be controlled (just turn on/off)
2. Only 1 motor can be used
3. Max size of a detail is 300x300 (3D printer constraints)
4. Max mechanism weight is 5 kg

Choose Project: Guideline

1) Come up with possible projects and fill the form
2) Discuss with instructor
3) ***Present a presentation (7 min, strict).*** **It should contain slides about:**
   a) **What is the Idea**
      To show up your project, what the problem you want to solve or what was your inspiration.
   b) **Challenges: what are the most complicated parts.**
      In some projects it can be to invent a design, in some - dynamics. Show your understanding.
   c) **Proposed constraints and boundaries: Min and Max dimensions, weight**
      The goal is to show that you understood how the final project should look like
   d) **Preliminary list of components and mechanisms:**
      It should be the list contains common mechanisms (crank shafts, worm gears), specific components (springs), materials (metal, plastic). Explain why do you need it.
   e) **Goals of kinematics, dynamics, durability analysis:**
      Exp: I need to generate traj. of an end-effector. I interested in positions for kinematics. My robot moves slowly, I don't need dynamics, only static analysis. It should survive after 20 kg load.

Kinematics: Guideline

1) **To understand what do you need to achieve.**
   Find only positions, or you need positions and velocities, may you need to find a gear ratio? Do you need to generate a trajectory?
2) **Draw a kinematics scheme**
   Tip: sometimes it's easier to make in CAD, to play with it and afterwards – code it (as you did in TM).
3) **Solve kinematics problem**
   For some cases - to write equations and check them by drawing plots or making a simulation (like in TM).
   If you need to generate a trajectory, you need to write fitness function, choose method, parameters and variables. Estimate obtained results.
4) **Write a report**
   Tip: assume that you are writing it for the guy, who haven't seen your project. It means, it's better to explain the goals of each step like - why do you finding kinematics and so on.

Dynamics: Guideline

1) **To understand what do you need to achieve.**
   Find torques, motion? Make only static analysis?
2) **Make force analysis**
   You need to get what forces are important. Maybe you have to consider friction or not. And so on
3) **Solve dynamics problem**
   You should do it using both simulation in NX and by coding. For making a simulation in NX you have to make very simple CAD model of your mechanism (without screws, etc)
4) **Write a report**
   Tip: assume that you are writing it for the guy, who haven't seen your project. It means, it's better to explain the goals of each step like - why do you finding dynamics and so on.

CAD + CAE modeling: Guideline

1) **Based on kinematics, dynamics make a CAD model**
   Tip: don't forget to add screws. You should use naming convention.
2) **Using NX estimate durability**
   If you get that something wrong, return to previous steps (CAD or even kinematics)
3) **To show your solution to classmates**
   It might help you to reduce amount of mistakes when you start to assemble and print details.
4) **Write a report**
   Emphasise on the reasons why did you apply X force on your model, how it should work in terms of loads, why did you choose such type of analysis.

Hardware assembly: Guideline

1) **Buy, find details**
   Don’t forget that the shipping needs some time. It’s not the reason for failing!
2) **Print details**
   You can ask your friends or fellows in lab or garage
3) **Assemble a mechanism**
   Good luck)

Final presentation: Guideline

1) Prepare CAD model render
2) **Prepare slides (7 min, strict)**
    a) Your original idea
    b) Challenges and how did you solve them
    c) What changed related to original idea
    d) What did you learn from the project and the course
    e) Present your mechanism
    f) Present your CAD render
    g) What would you do in other way if you had such project again

Best projects: Guideline

1. Together we are choosing the appropriate journal/conference.
2. Rewriting your report based on needed template
3. Submit it
4. ...
5. Profit! You have your new awesome scientific article

Deserve “A” grade!

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