

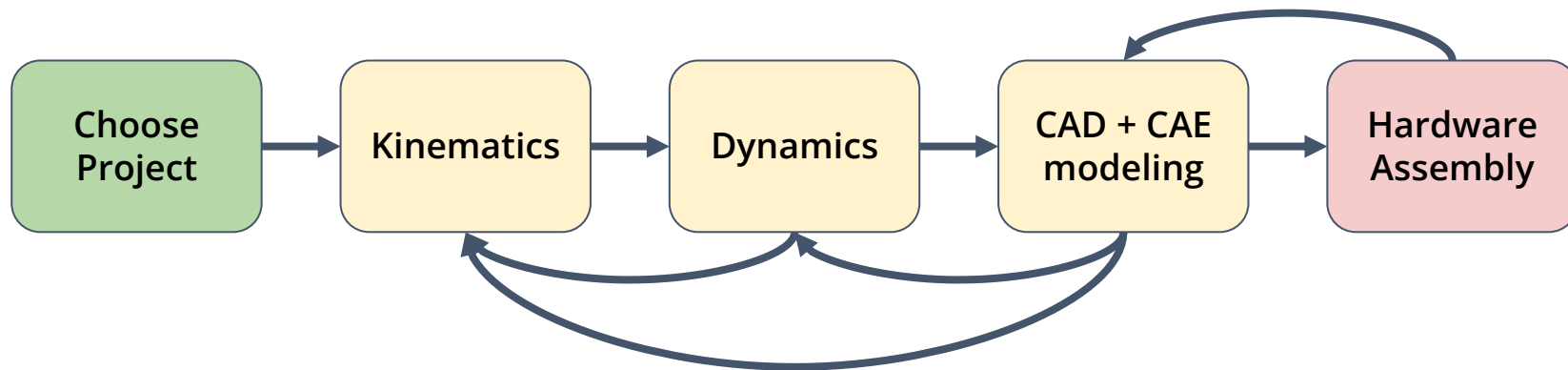


# Mechanics and machines

Project

# Possible projects

# Workflow



# Best projects will be published

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

Example: [paper](#)  
(recommend to get acquainted)



# 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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