Dynamics 003 (Fall term, 2008)

- Course number: 446.204A Lecture number: 003
- Credit: 3
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- Office hours: Every Mon, Wed after class till 3pm at Bldg. 301 Rm. 1504

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- Office hours: TBA at Bldg. 301, Rm. 219

- Course Objective: Develop an ability to analyze a problem involving things in motion in a simple a nd logical manner and to apply to its solution a few well understood basic principles.

- Textbook/Reference: F. P. Beer, et al., "Vector Mec hanics for Engineers, Dynamics," 8th Edition in SI Units, McGraw-Hill, 2007. (7^{th} edition can be use d)

  Dynamic, Beer & Johnston McGraw Hill, 2005 (번역판: 동역학 역자 이장무, 2005년)

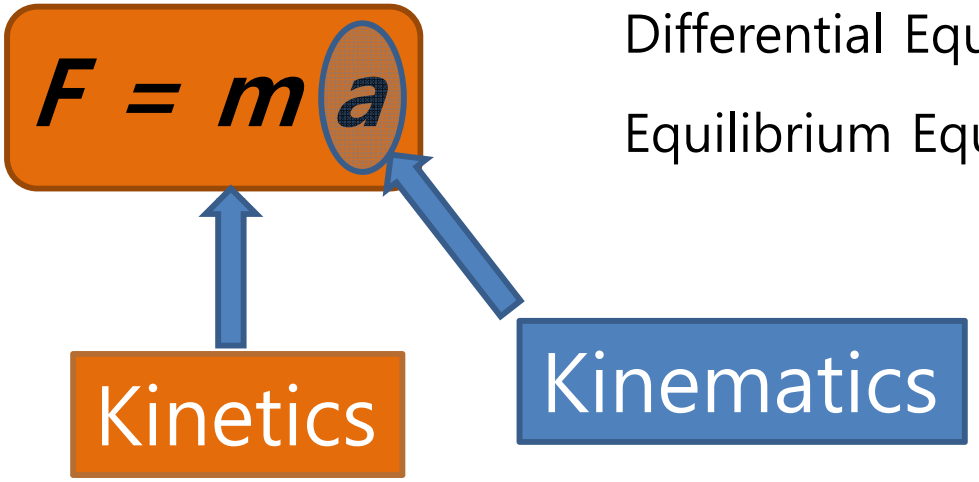
Grading

- Problem sets: Given after end of each chapter, On/Off Check (5%)
- Snap Quizzes (15 ~20 minutes) 15%
  - During Recitation/Class
  - One problem from homework
- Midterm Exam (30%): Week 8
- Project (10%)
- Final Exam (35%): Last week of class
- Participation (5%): Online/ Offline

Project

- Use Working Model 2D to design a problem that you are interested in.
- Solve them using the theories learned in class!
- Specific guide lines, and examples will be given later.
- Selected projects will be used as a final exam problem.
- Will be due two weeks before the final exam.

Essence of Dynamics



Differential Equation

Equilibrium Equation

$$T = I \alpha$$

Map of the course

		Kinematics	Kinetics
Motion of Particles	Linear		
	Angular		
Motion of system of particles	Linear		
	Angular		
Rigid body dynamics	Linear		
	Angular		

Also covered: 3D Rigid Body Dynamics, Vibration

Few important topics

- Relationship between F, m and a
- Free Body Diagram
- Motion after Impact
- Conservation of Momentum
- Motion after certain period of time
- Conservation of Work/Energy

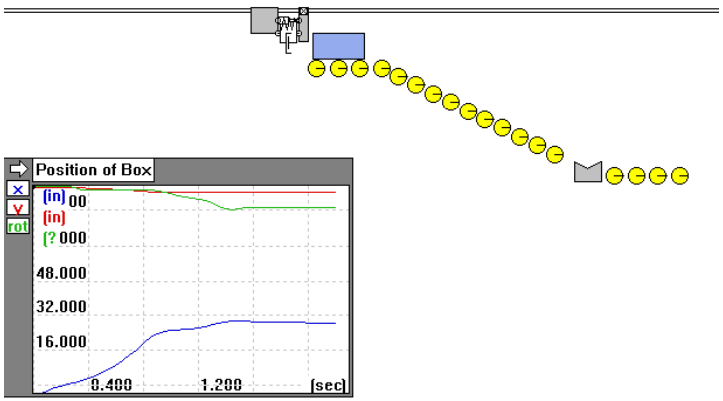
- Dynamics is one of the many tools used to solve a real world problem.
- Understand what kind of problems you can solve and what you cannot.
- Understand what methods you can use to solve the problem depending on the type of a problem.
- Understand what the assumptions are.

Other Tools

- Matlab: Students are encouraged to use matlab t o simulate the motion with different parameters

- Working model 2D: Students are encouraged to us Working model 2D
- http://www.design-simulation.com/WM2D/index.php
- Motion simulation software.
- Demo version is free. Full versions will be install ed in the computer lab later in the semester.

This model demonstrates the power of simulating collisions with friction. Here, a box travels over a conveyor system and is flipped by 180 degrees near the bottom.



TASK

Design a system that transports boxes and rotates the box at the end of the rail.

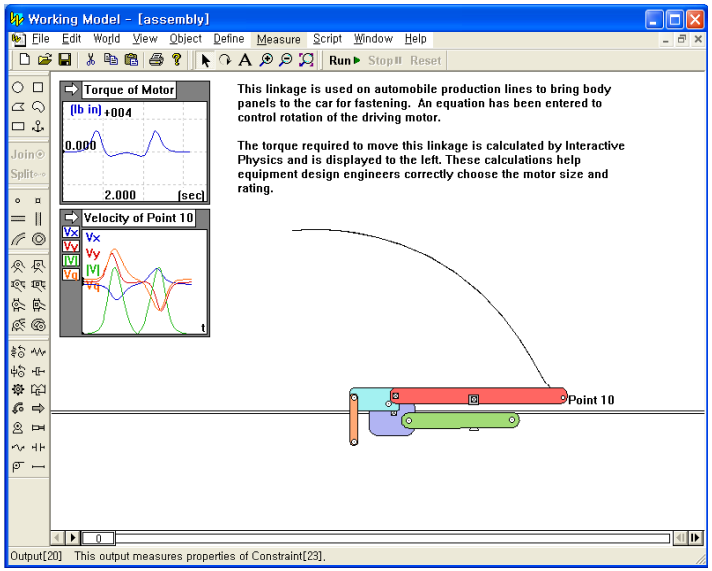
What do you want to know?

What's the force required?

Actuator Spec? Control?

Assumptions?

No friction, Rigid Body, 2 D, Uniform.....



TASK

Design a mechanism that moves a door in an assembly line

What do you want to know?

What's the linkage length? Kinematics

What's the motor spec? (Maximum torque)

How to control the motor?

Assumptions: No friction, Rigid Body, Uniform…

Conclusion

Dynamics is Fun and Useful!!!