ME 230 Kinematics and Dynamics

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Final Project

- Design and construct a simple mechanical system and explain how it works using particle or planar kinematics and kinetics you learn in ME 230.

Rules

- Explain at least three components in your device using planar kinematics and kinetics (okay one component can be particle)
- Construct the device and perform tests on those three components in your design
- Write up a report based on the format describe on the final report assignment.
- More interesting and challenging the design and analysis the more extra credit you will get.

Grade breakdown

- 20% proposal
- 30% hardware
- 50% final report

Project Topics

- Mechanical Toy Design
- Mechanical System
- Motor, Engine design
- Gadgets
- Clock design
- Perpetual motion machine
- Mechanical Calculator
- Amusement Park Rides
- Slot Machine, Pachinko Machine
- Shock absorber, bumper design
- Rude Goldberg Machine
- Eraser
- Rubber band propel airplane
- Variable damper (spring with different diameter)
- Electronic circuit (DC only)

Things to include in the proposal

- Briefly describe your proposed design.
- What is the function of your machine?
- List and describe the components (provide drawings or illustrations)

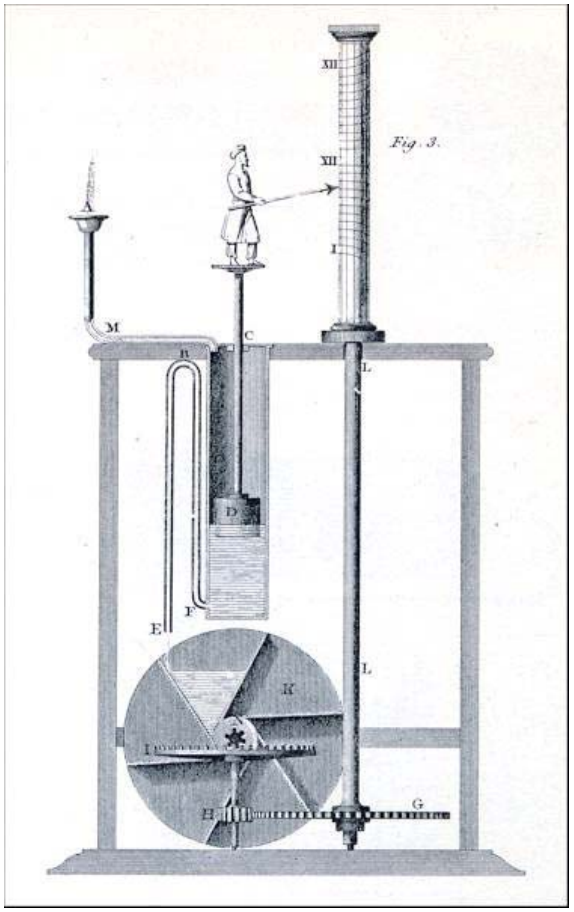
Extra Credits

Water Calculator

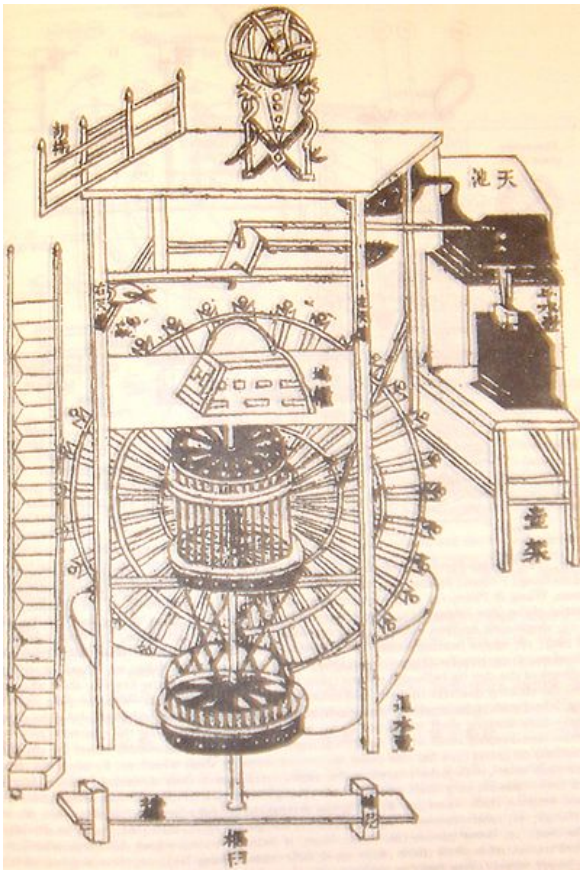
Water Clock

The fenjaan consisted of a large pot full of water and a bowl with a small hole in the center. When the bowl became full of water, it would sink into the pot, and the manager would empty the bowl and again put it on the top of the water in the pot. He would record the number of times the bowl sank by putting small stones into a jar.[4]
The place where the clock was situated, and its managers, were collectively known as *khaneh fenjaan*. Usually this would be the top floor of a public-house, with west- and east-facing windows to show the time of sunset and sunrise. There was also another time-keeping tool named a *staryab* or astrolabe, but it was mostly used for superstitious beliefs and was not practical for use as a farmers' calendar. The Zeebad Gonabad water clock was in use until 1965 when it was substituted by modern clocks.[3]

Water clock



Greco-Roman world



China

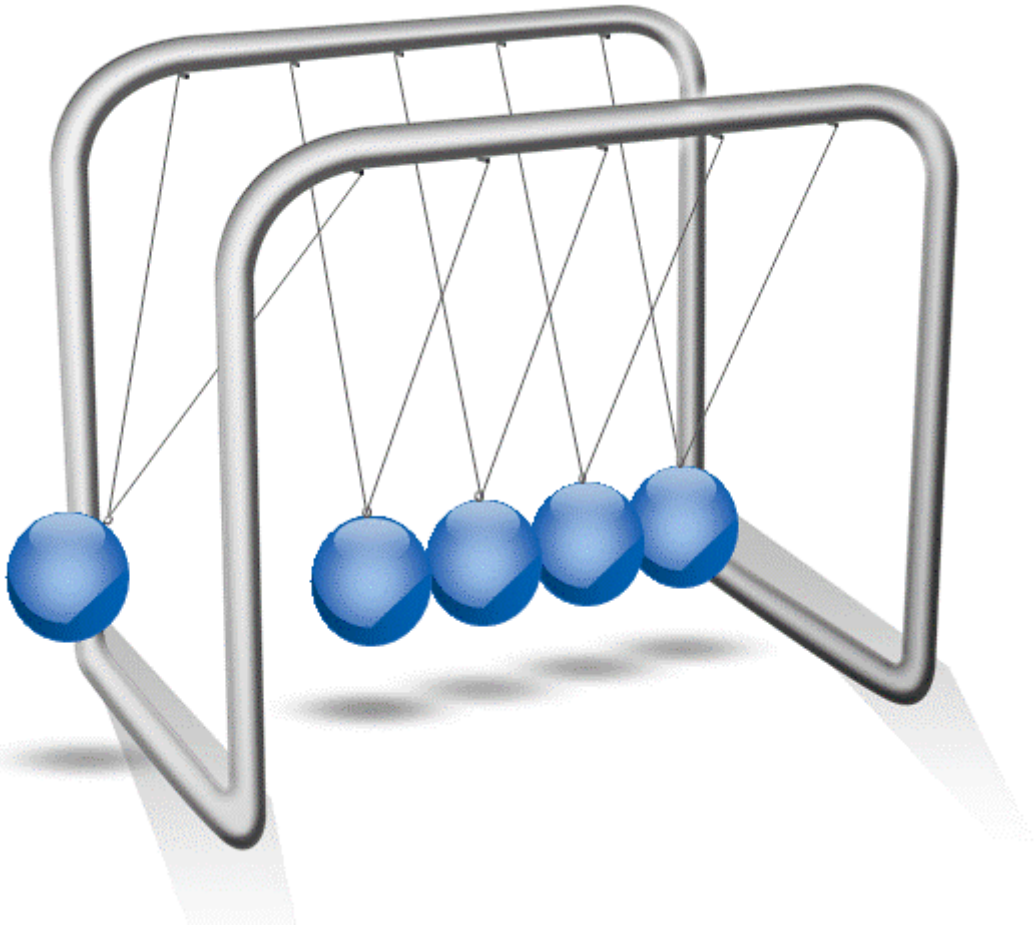
[Bernard Gitton](#) began creating his Time-Flow Clocks

Mechanical Calculator

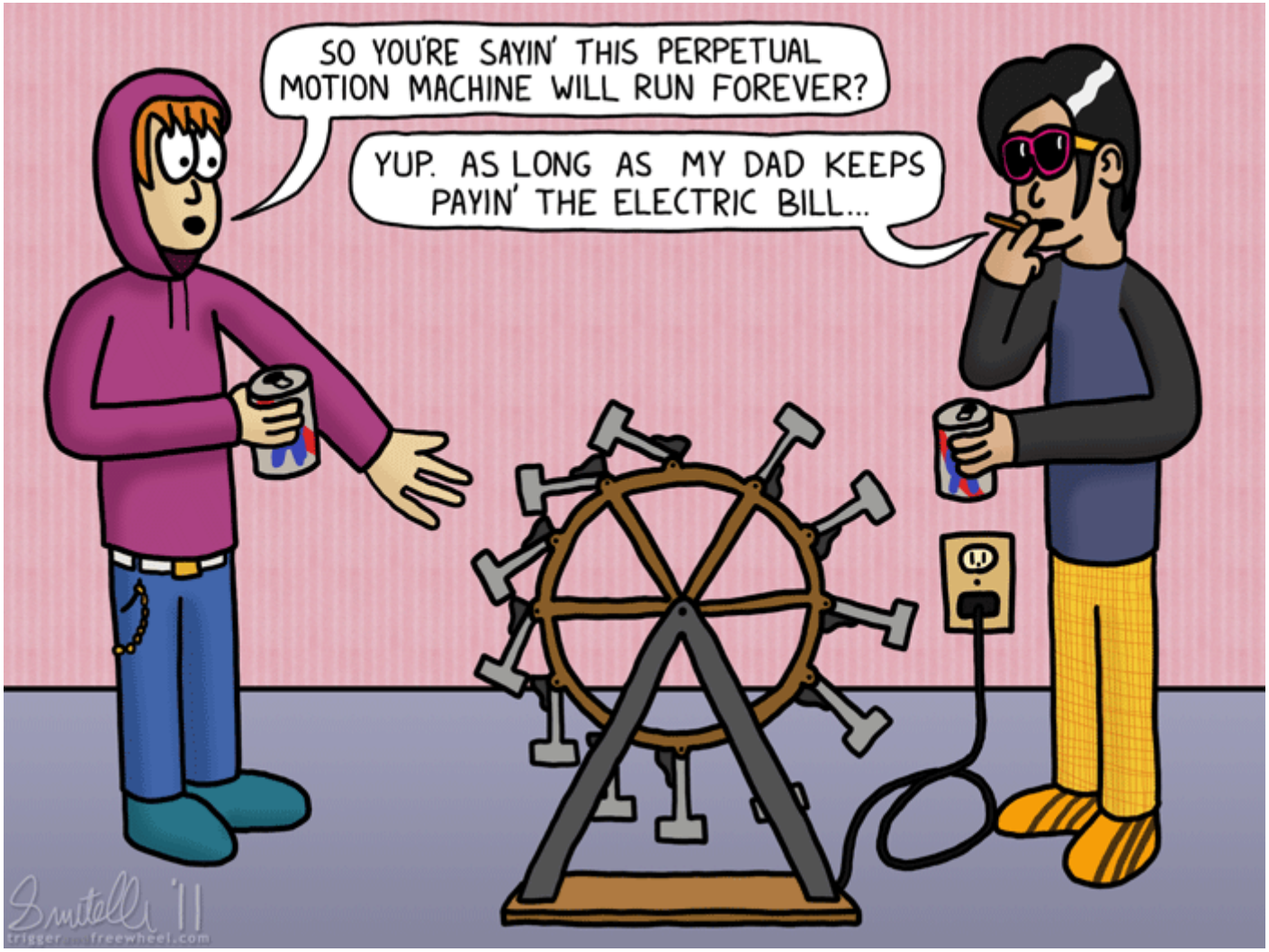
- **Curta Miniature Mechanical Calculators**

Mechanical Integrator

1917 Mechanical Integrator
Stanford Computer Science Computer History Display



perpetual motion machine


SO YOU'RE SAYIN' THIS PERPETUAL MOTION MACHINE WILL RUN FOREVER?
YUP. AS LONG AS MY DAD KEEPS PAYIN' THE ELECTRIC BILL...

Electrical and Mechanical System Analogy

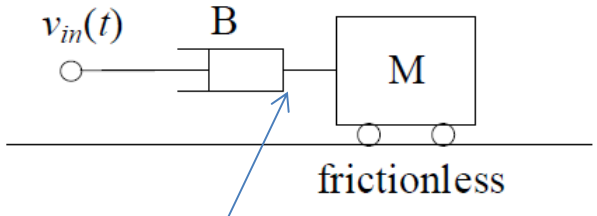
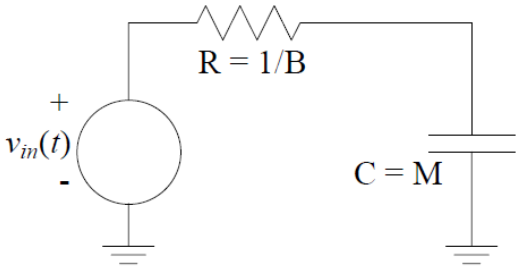


Fig. 1. Mechanical system.

Electromagnetic force



Shock absorber

	'Forcing' Term	'Flow' Term	Time derivatives
Mechanical	Force	Velocity (displacement)	Displacement -> Velocity -> Acceleration
Electrical	Voltage	Current (Charge)	Charge -> Current -> di/dt

Analogy between Mechanical and Electrical Terms

	Mechanical Domain		Electrical Domain	
Store energy	Spring (k)	$f_s = kx_s$	Capacitor (C)	$V_c = \frac{1}{C} q_C$
Dissipate energy	Damper (b)	$f_d = bv_d = b\dot{x}_d$	Resistor (R)	$V_R = Ri_R = R\dot{q}_R$
'Inertial' behavior	Mass (m)	$f_m = ma_m = m\ddot{x}_m$	Inductor (L)	$V_I = L\frac{di}{dt} = L\ddot{q}_i$

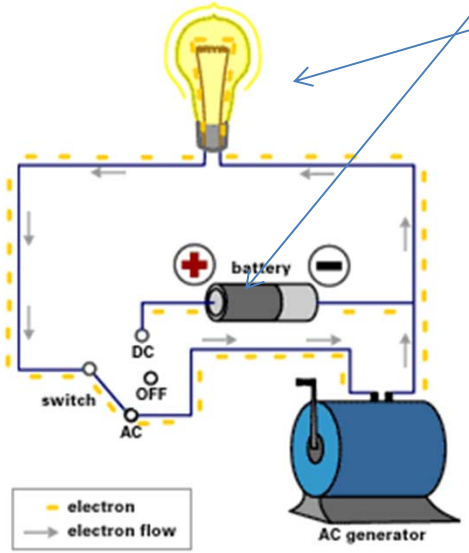
Relationship between Constitutive Elements in Mechanical & Electrical Domains

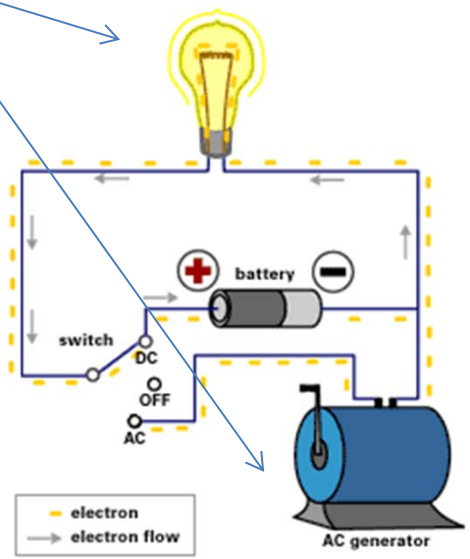
Light bulb is a Resistor

V = IxR (Ohm's Law)

P= VxI (power provided by power supply)

$P_R = I^2xR$ (power dissipated in resistor)





AC (household (60HZ)

DC

Final Project

Proposal for design project (GROUPS)

The CS student finally realizes the meaning of the word "deadline".

Deadline: Proposal due Feb. 14