

Panel 1

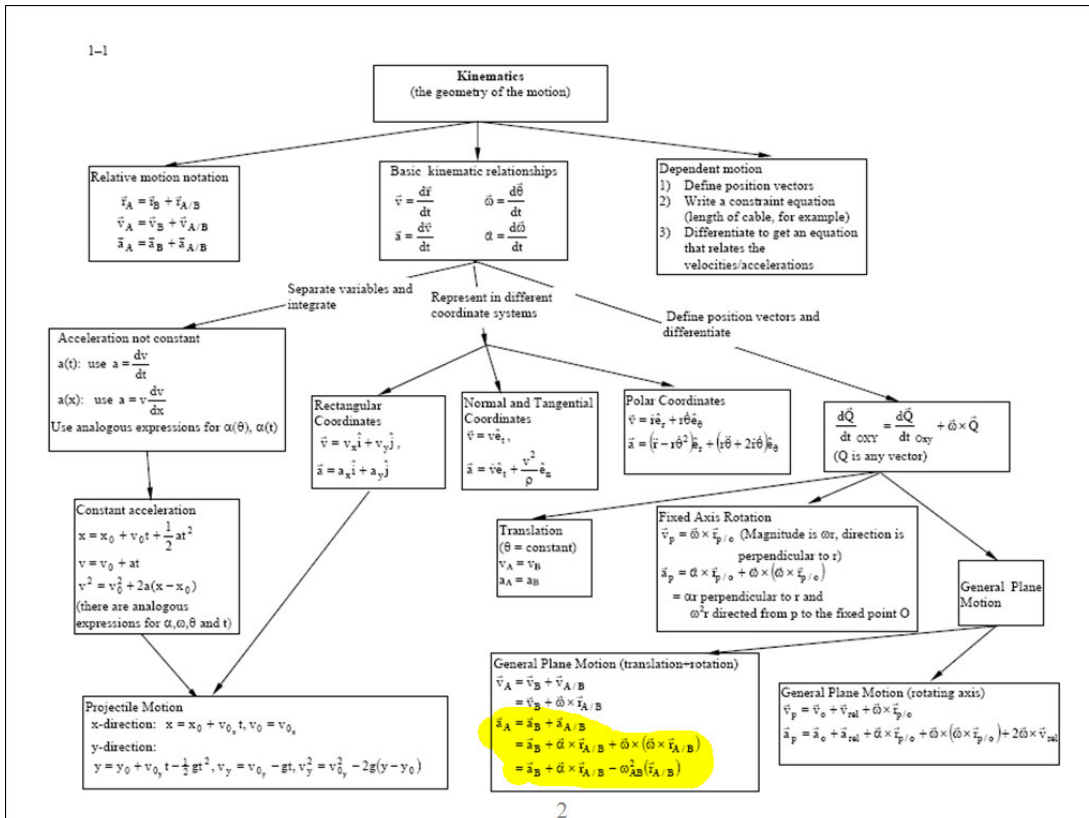
ES204 Mechanical Systems

General Plane Motion Momentum Rate Lecture 22

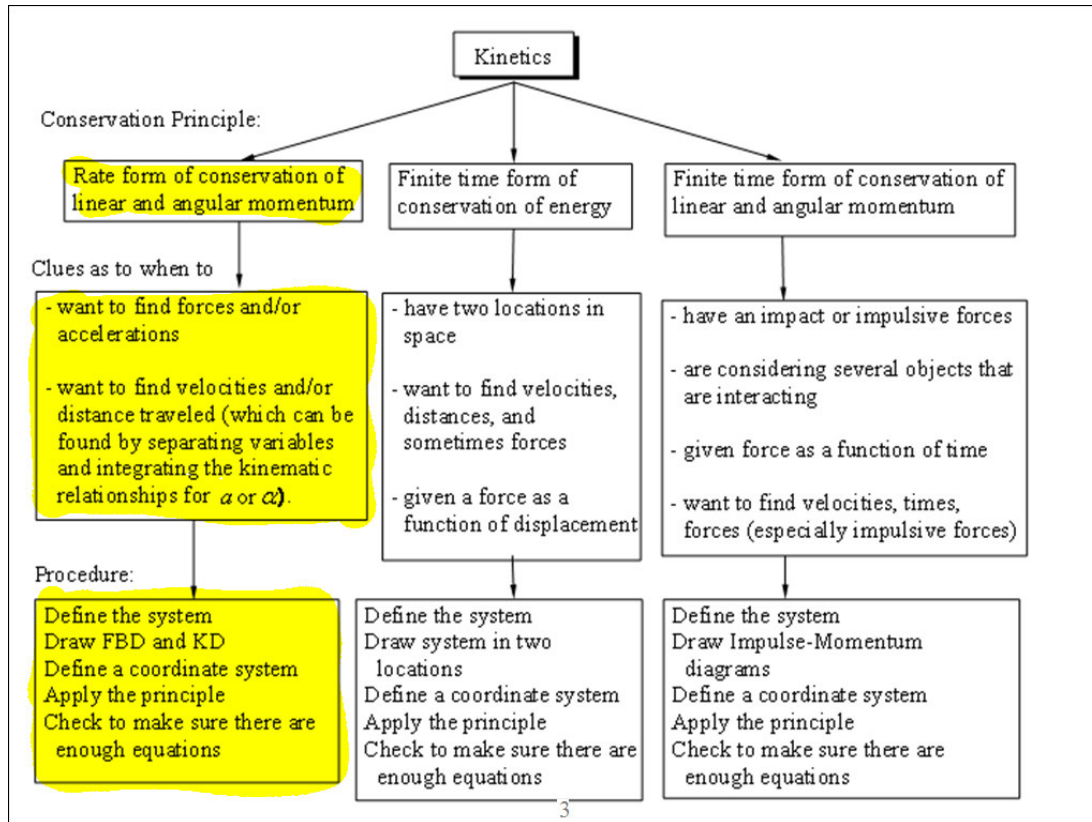
Dr. Fisher

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Panel 2



Panel 3



Panel 4

Rigid Body Motion Matrix

	Kinematics	CoLM CoAM Rate	Energy	CoLM CoAM Finite
Translation	Le10	Le10	✓	✓
Fixed Axis Rotation	Le11	Le12	Le12	Le13
General Plane Motion	Le14 Le15	Today	Le16	Le19 Le20

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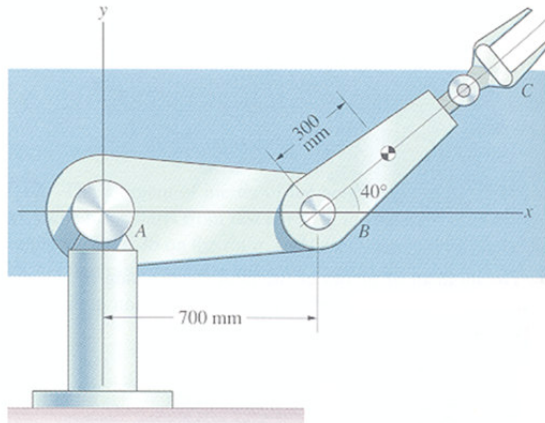
Panel 5

Arm BC has a mass of 12 kg and the mass moment of inertia about its center of mass is $3 \text{ kg}\cdot\text{m}^2$. If arm AB has a constant clockwise angular velocity of 2 rad/s and arm BC has a counterclockwise angular velocity of 2 rad/s and a clockwise angular acceleration of 4 rad/s^2 ,

determine:

- a) the couple exerted on arm BC at B,
- b) the reaction at B

(taken from Dynamics, 2nd Edition by Bedford & Fowler)



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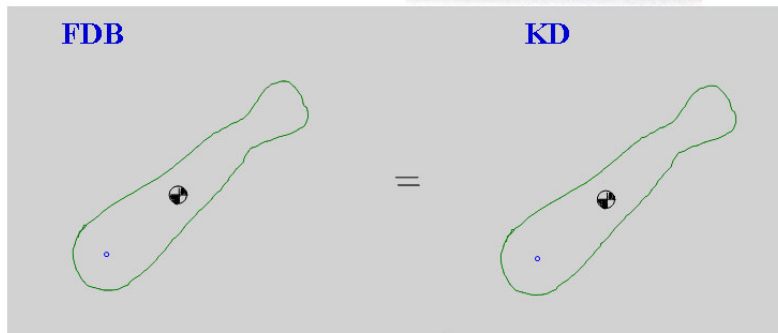
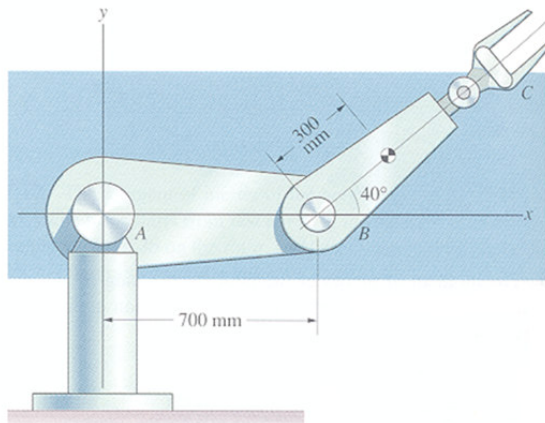
Panel 6

Arm BC has a mass of 12 kg and the mass moment of inertia about its center of mass is $3 \text{ kg}\cdot\text{m}^2$. If arm AB has a constant clockwise angular velocity of 2 rad/s and arm BC has a counterclockwise angular velocity of 2 rad/s and a clockwise angular acceleration of 4 rad/s^2 ,

determine:

- a) the couple exerted on arm BC at B,
- b) the reaction at B

(taken from Dynamics, 2nd Edition by Bedford & Fowler)



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Panel 7

FDB

KD

CoAM Rate about B

CoLM Rate in the x

CoLM Rate in the y

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Panel 8

Arm BC has a mass of 12 kg and the mass moment of inertia about its center of mass is 3 kg-m². If arm AB has a constant clockwise angular velocity of 2 rad/s and arm BC has a counterclockwise angular velocity of 2 rad/s and a clockwise angular acceleration of 4 rad/s², determine:

- the couple exerted on arm BC at B,
- the reaction at B

(taken from Dynamics, 2nd Edition by Bedford & Fowler)

$\vec{a}_B = \vec{a}_A + \vec{\alpha}_{AB} \times \vec{r}_{B/A} - \omega_{AB}^2 \vec{r}_{B/A}$

$\vec{a}_A =$

$\vec{\alpha}_{AB} =$

$\vec{r}_{B/A} =$

$\omega_{AB} =$

$\vec{a}_{cg} = \vec{a}_B + \vec{\alpha}_{BC} \times \vec{r}_{cg/B} - \omega_{BC}^2 \vec{r}_{cg/B}$

$\vec{\alpha}_{BC} =$

$\vec{r}_{cg/B} =$

$\omega_{BC} =$

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Panel 9

FDB

KD

=

CoAM Rate about B

CoLM Rate in the x

CoLM Rate in the y

Kinematics

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Panel 10

The 3-oz yo-yo shown has a centroidal radius of gyration of 1.25 in. The radius of the inner drum on which a string is wound is 0.25 in. Knowing that at the instant shown the acceleration of the string is 3 ft/s² upward, determine:

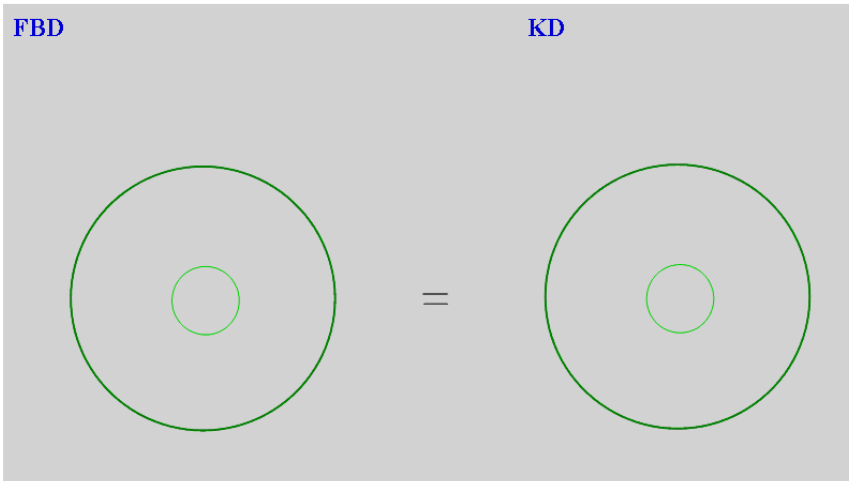
- The tension in the string
- The angular acceleration of the yo-yo

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Panel 11

The 3-oz yo-yo shown has a centroidal radius of gyration of 1.25 in. The radius of the inner drum on which a string is wound is 0.25 in. Knowing that at the instant shown the acceleration of the string is 3 ft/s² upward, determine:

- A) The tension in the string
- B) The angular acceleration of the yo-yo

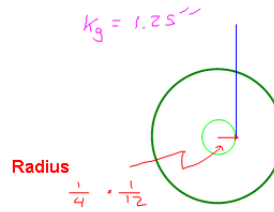
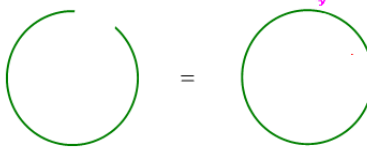


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Panel 12

FBD

KD



CoAM Rate about cg

CoLM Rate in the x

CoLM Rate in the y

Mass Moment of Inertia

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Panel 13

Radius $\frac{1}{4} \cdot \frac{1}{2}$

$$\vec{a}_P = \vec{a}_g + \vec{\alpha} \times \vec{r}_{P/g} - \omega^2 \vec{r}_{P/g}$$

$\vec{a}_P = a_{Px} \hat{i} + 3 \hat{j}$ (Given)

$\vec{a}_g =$ []

$\vec{\alpha} =$ []

$\vec{r}_{P/g} =$ []

$\omega =$ []

Acceleration equation in component form (plug in values)

i equation []

j equation []

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Panel 14

FBD **KD**

CoAM Rate about cg

CoLM Rate in the y

Kinematics

$k_g = 1.25$

Radius $\frac{1}{4} \cdot \frac{1}{2}$

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