

EN1740 Computer Aided Visualization and Design

Spring 2012

4/24/2012

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Last Time:

• Motion analysis with Pro/E

Tonight:

• Motion analysis with Pro/E (cont.)

Motion Analysis

- Further functions within the mechanism application:
 - Gears
 - Cams
 - Springs



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Motion Analysis

- From the Supporting Materials page download and open pistcrank_2.zip
 - This will pick up where we left off
 - Has additional parts
- Tonight we'll add:
 - A set of "gears" for timing
 - A cam to open and close the valve
 - A valve with spring force



EXERCISE - Motion Analysis

Create Valve height reference

- Go back to the Standard Application
- Create a new datum plane, offset up from ASM_TOP 80mm



EXERCISE - Motion Analysis

Create Valve height reference

- Switch to the Mechanism application
 - Application > Mechanism
- Make sure the mechanism is in its home position
 - From mechanism tree, Expand Motors
 Servos > crank
 - RMB on Rotation Axis > Edit Definition...
 - Set Current Position to 0.00



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EXERCISE - Motion Analysis

Assemble Valve component

- Switch back to the Standard application
- Assemble in the *valve* component
 - Insert > Component > valve.prt
 - From Constraint Type dropdown select Cylinder



EXERCISE - Motion Analysis

Assemble Valve component

- Use the following constraints:
 - Align the Valve axis to the axis we created through the center of the rod
 - Select Valve's Top and the new datum plane (ADTM1) for Translation
 - Align Valve's Front and ASM Right for Rotation
- Make sure the slot for the wheel is oriented as shown



EXERCISE - Motion Analysis

Assemble Wheel component

- Insert > Component > wheel.prt
- Select Pin from Constraint type
 - Align center axis with through hole in Valve
 - For Translation, align the Wheel's Front plane with the Valve's Front plane
 - For Rotation, align the Wheel's Top to the Valve's Top



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EXERCISE - Motion Analysis

Create a new datum and axis

- Create a datum plane
 - Offset from ASM_TOP 141mm
- Create a datum axis
 - Create at intersection of planes
 - Use new datum and ASM Front



EXERCISE - Motion Analysis

Assemble Cam component

- Insert > Component > cam.prt
- Select Pin from Constraint type
 - Align center axis with new datum axis (AA_3)
 - For Translation, mate-offset the Cam's Front plane 8.00 from ASM Right
 - For Rotation, align the Cam's Top to the new datum plane (ADTM2)



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EXERCISE - Motion Analysis

Save what we've got

• SAVE!!



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EXERCISE - Motion Analysis

Switch Applications

- Switch applications back to Mechanism
- Edit > Reconnect > Click Run...
- Should see a dialog saying mechanism assembly succeeded
- Click Yes



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EXERCISE - Motion Analysis

Create Cam Connection between cam and wheel

• Cam and Wheel surfaces need to be connected as a Cam

- Click Cam
- Select *Entire* outer surface of Cam
- Select *Entire* outer surface of Wheel
- Make sure normals are pointing in the right direction

• Use the Drag function to make sure this is working



EXERCISE - Motion Analysis

Create Gear Connection between crank and cam

- These parts need to be connected by a set of "gears"
 - Click on Rotation Axis for the Crank for Gear 1
 - Click on Rotation Axis for the Cam for Gear 2
 - Use 10mm diameter for each gear
- Use the Drag function to make see output



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Gear Pair Definition

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EXERCISE - Motion Analysis

Set remaining part densities to s

- New parts need densities set to steel
 - 7.827e-9 tonne/mm³ •
- Use Mass Properties tool

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EXERCISE - Motion Analysis

Redefine Servo Motor

- From Mechanism tree, redefine the crank servo motor
- Use a Position specification
- For Magnitude select Ramp with constants A=0 and B=360





EXERCISE - Motion Analysis

Redefine Analysis

- Run a Dynamic analysis type
- Select Length and Rate for to specify analysis period
 - Duration=1
 - Frame Rate = 99
- Run the analysis
- Click OK

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Analysis Definition

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EXERCISE - Motion Analysis

Evaluate key measures

- Open the Measures tool
- Load the results set
- Create a "Connection Reaction" measure for the center of the wheel
- Graph each measure and notice the limits

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EXERCISE - Motion Analysis

Create a Spring

- Click on the Spring tool
- Set the rate to 10N/mm
- Set initial displacement to 2mm
- Re-run the analysis and check the measure on the wheel
 - What happened?

