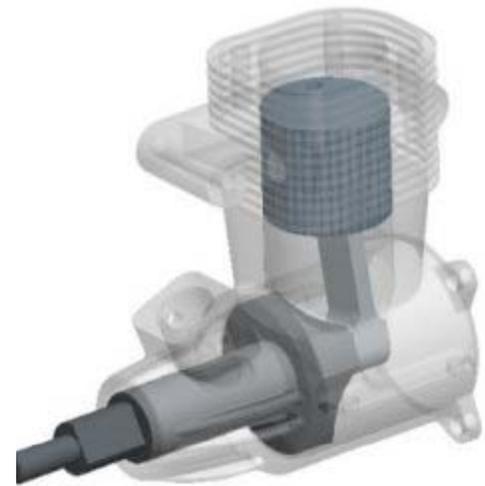
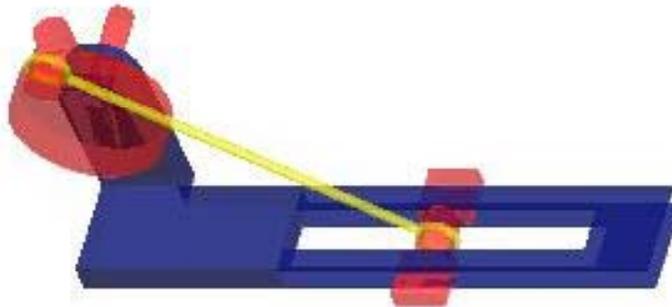


# **ASSEMBLY MODELING and MOTION ANIMATION**

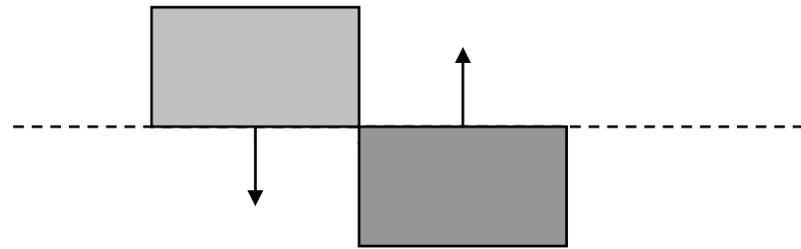
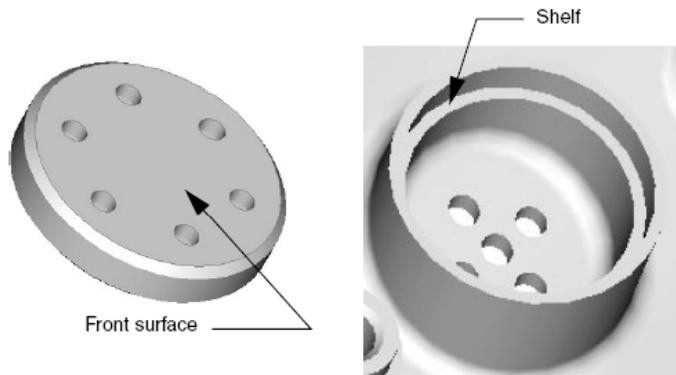
## **Using Pro/ENGINEER**



# Six Common Assembly Constraints

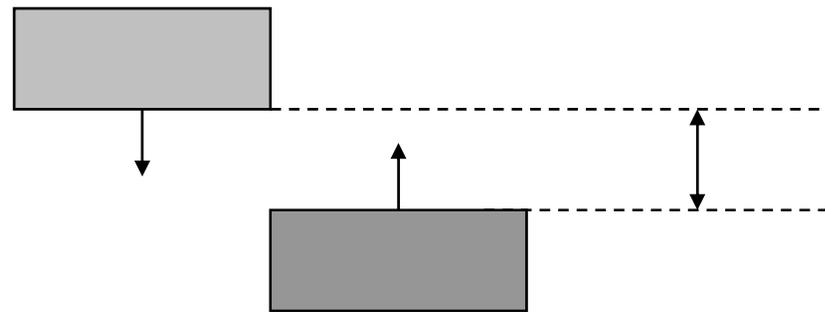
## MATE (or MATE COINCIDENT)

Two planar surfaces or datums become coplanar and face in opposite directions.



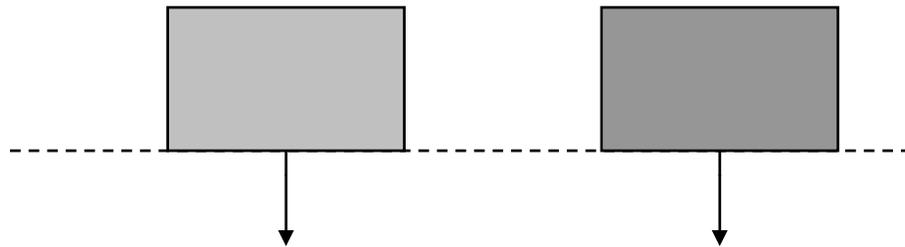
## MATE OFFSET

Two planar surfaces or datums are made parallel, with a specified offset distance, and face in opposite directions. The offset dimension can be negative.



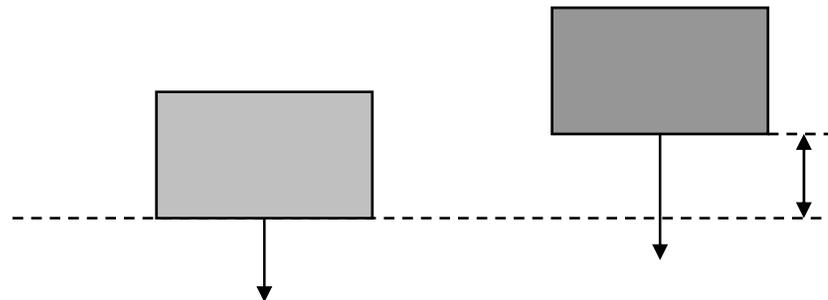
## **ALIGN (or ALIGN CONINCIDENT)**

This can be applied to planar surfaces, datums, revolved surfaces and axes. Planar surfaces become **coplanar** and face in the **same direction**.



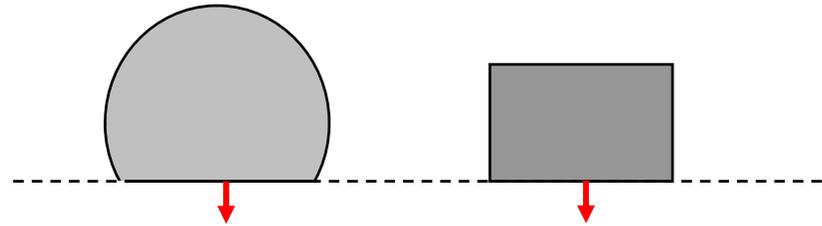
## **ALIGN OFFSET**

This can be done only with planar surfaces: they become **parallel** with a specified **offset** and face the **same** direction.



## ALIGN ORIENT

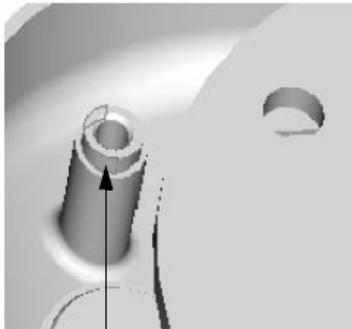
Two planar surfaces or datums are made **parallel and face the same direction** (similar to Align Offset except without the specified offset distance).



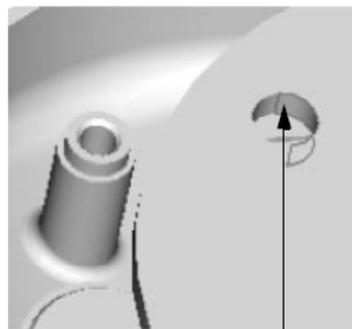
## INSERT

This constraint can only be used with **two surfaces of revolution** in order to make them **coaxial**.

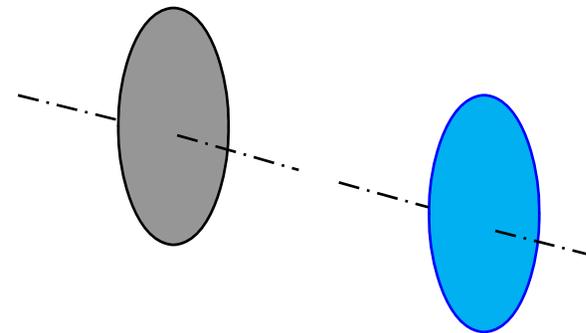
*Third reference set for the PC board*



Outside cylindrical area

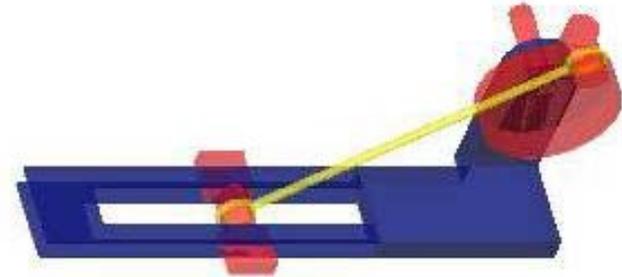


Inside of the corresponding hole



# Other Functions in Assembly Generation

- Add Color
- Create a Cutout View
- Create an Exploded View
- Generate Assembly Drawing
  - Dimensions for Defining Overall Size
  - Assembly Dimensions
- Motion Animation ([Pro/ENGINEER Wildfire 4.0 Design Animation Concepts Guide from PTC](#))
- Run a Simple Mechanism ([Pro/Assembly](#), [Pro/Animation](#) and [Pro/Mechanism Design Tutorials](#))



Key dimensions needed on an assembly drawing



## MECH 410 and MECH520 Computer Aided Design

Course Homepage: <http://www.me.uvic.ca/~mech410/>

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E-mail: [zdong@uvic.ca](mailto:zdong@uvic.ca) Research Interests: <http://www.me.uvic.ca/~zdong/>

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(This website will be continuously updated and activated.)

### [Course Outline](#)

### [Lab, Project and Time Schedule](#)

### **Laboratory Information and Report Formats**

### **Lecture Notes**

- [Course Outline and Background Information \(condensed slides\)](#)
- [Introduction to CAD/CAE/CAM and Technology Review](#) □(condensed slides)
- [Computer Hardware for CAD \(condensed slides\)](#)
  - ✧ [Technical References on 3D Scanning and Computer Model Generation](#)
- [An Introduction to the Pro/ENGINEER Design Modeling System \(Linked to Pro/E Tutorials and Lecture Notes\)](#)
  - [An Overview of Pro/ENGINEER \(condensed slides\)](#)
  - [About Pro/ENGINEER Tutorials \(condensed slides\)](#)
  - [Assembly Modeling and Motion Animation](#) □(condensed slides)
- [Graphical Coordinate Systems and Basic Geometric Transformations \(condensed slides\)](#)
- [Rotation about an Arbitrary Axis \(condensed slides\)](#)
- [Geometric Projections \(condensed slides\) \(notes in Word\)](#)
- [Computer Modeling Techniques \(condensed slides; notes in Word\)](#)
- [Advanced Applications of Pro/ENGINEER](#)
  - ✧ [An Over View of Pro/MECHNICA and Applications of Pro/M Structure \(condensed slides\)](#)
  - ✧ [A Review of Finite Element Analysis Method \(condensed slides\)](#)
  - ✧ [Design of Sculptured Part Using Pro/ENGINEER \(condensed slides\)](#)
  - ✧ [CNC Tool Path Generation and Simulation Using Pro/ENGINEER \(condensed slides\) \(5-axis machining video\)](#)
- [An Introduction to Design Optimization \(condensed slides\)](#)
- [Example Problems for Quiz I](#)
- [Representation of Curves \(condensed slides\)](#)
- [Representation of Surfaces \(condensed slides\)](#)
  - [Generation of Free-form Surface in Pro/ENGINEER \(condensed slides\)](#)
- [Interactive Computer Graphical Programming \(condensed slides\)](#)
- [Data Organization in CAD](#) □ □(condensed slides)
- [An Overview of SolidWorks, COSMOSWorks, COSMOSXpress and COSMOSMotion \(condensed slides\)](#)
- [Example Problems for Quiz II](#)
- [Research on Virtual Prototyping, Design Optimization, RP and Fuel Cell Vehicle Systems](#)

### [Pro/ENGINEER Tutorials and Related Documents](#)

**Unigraphics NX Tutorials and Related Documents** (available soon)

## Pro/Engineer Related Documents and On-Line Tutorials

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### I. Pro/ENGINEER Wildfire 4.0 Tutorials

1. [Getting Started with Pro/ENGINEER Wildfire 4.0 from PTC](#) (PDF Version)  
□□□□□□□□□□ Pro/E Concepts, User interface, Part Modeling, Assembly Modeling and Drawing Generation.
  2. [Pro/ENGINEER Wildfire 4.0 Introduction Tutorial link to PTC Webpage](#)
  3. [Pro/ENGINEER Wildfire 4.0 Quick Reference Card from PTC](#) (PDF Version)
  4. [Pro/ENGINEER Wildfire 4.0 Design Animation Concepts Guide from PTC](#) (PDF Version)
  5. [Pro/Assembly](#), [Pro/Animation](#) and [Pro/Mechanism Design](#) Tutorials  
Pro/E Part and Assembly Model Files: [part1](#); [part2](#); [part3](#); [Tutorial2a\\_assembly](#); [Tutorial2b\\_assembly](#).  
Pro/E Animation of the Assembly: [Tutorial\\_2b](#); [Tutorial\\_2c](#)
  6. ProMECHANICA [Structural and Thermal Analysis \(example part\)](#) (WF 2.0, unchanged)
  7. ProMECHANICA [Sensitivity Analysis and Design Optimization \(example part\)](#) (WF 2.0, unchanged)
  8. [Pro/ENGINEER Wildfire 4.0 Manufacturing □ Volume Milling Tutorial](#) (PDF Version)
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### II. Pro/E Reference Books and Student Edition:

- o [SDC Publications Pre/ENGINEER Book Series](#)
  - o [Pro/ENGINEER Student Edition \(software and tutorials\)](#)  
Tutorial book and software of Pro/E student edition can be purchased on-line from *JourneyEd Publishing* at a modest cost.
  - o [Parametric Technology On-Line Information](#)
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### IV. Pro/ENGINEER On-Line Tutorials for Previous Releases