EXERCISE BOOK Student Notes: **CATIA V5 Training** Exercises **Product Design Expert** Copyright DASSAULT SYSTEMES Version 5 Release 19 September 2008 EDU_CAT_EN_ASM_AX_V5R19

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PC Speaker Assembly Exercise

Step 1: Preparing the Session

Step 4: Analyzing Assembly

Step 6: Replacing Components

Step 5: Design in Context

Step 7: Managing Structure

PC Speaker Assembly Presentation

Step 2: Creating the Product Structure

Step 3: Positioning the Components

Student Notes:

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Connector Assembly

You will practice concepts learned throughout the course, by building the master exercise and following the recommended process

- Connector Assembly : Presentation
- Connector Assembly (1): Assembling Components
- Connector Assembly (2): Positioning Components
- Connector Assembly (3): Analyzing the Assembly
- Connector Assembly (4): Fixing the clash
- Connector Assembly (5): Adding Screws

Connector Assembly

Exercise Presentation



Objectives :

In this exercise you will build the Connector Assembly and modify one of its components.

In this Exercise you will use :

- Product Structure Tools
- Assembly Constraints
- Compass
- Clash Analysis
- Part Design in Context
- Standard Tools



Connector Assembly

EXERCISE BOOK





Student Notes:

Connector Assembly

Step 1: Assembling Components



In this step you will:

- Create a new assembly and name it
- Insert existing components
- Assign instance names
- Save the assembly





Do It Yourself (2/2)



You can compare your result with the "CATASM_Connector_Assembly2.CATProduct"

Rename the two instances of "Connector Shell" as "Top Shell" and "Bottom Shell"

ക്ലി	Co	nne	eto	r As	ser	nb	ly
<u>а</u> ,	_	~			01		<u>_</u>

- Connector Shell (Top Shell)
- Connector Card Assembly (Connector Card Assembly.1)

-	Connector	Shell	(Bottom	Shell
---	-----------	-------	---------	-------

	12		
-Ap	plic	atio	ns

Pr	operties			
c	Current sele	ction : Top :	5hell/Connector	Assembly
	Graphic	Product	Mechanical	Drafting
	Compone	ent		
5	Instance n	ame Top Sh	ell	
	Description			

- Save the assembly as "CATASM_ConnectorAssembly2.CATProduct" in a new folder "Connector_Assembly" using 'Save Management'
 - Click on Propagate Directory to save all documents in same folder

State	Name	Location	Save
Open	CATASM_Connector_Assembly2.C	C:\Documents and Settings\vkw\Appli	Save As
Open	CATASMConnector_Card_Assembl	C:\Documents and Settings\vkw\Applic	Dupper the dupper
Open	CATASMConnector_Shell.CATPart	C:\Documents and Settings\vkw\Applic -	eropagase director
Open	CATASMConnector_Card.CATPart	C:\Documents and Settings\vkw\Applic	Reset
Open	CATASMConnector Socket Recep	C:\Documents and Settings\vkw\Applic	
•	Isma # Asplu Data		~
accentri	Apply Pato	eni	
Unsave	ed File(s) Left 📃 Enabl	le independent saves	

EXERCISE BOOK

Student Notes:

Connector Assembly

Step 2: Positioning Components



In this step you will position the components using compass and constrain them by using following constraints:

- Fix Component constraint
- Coincidence constraint
- Contact constraint





Student Notes:

Do It Yourself (2/4)

- Set an axial coincidence between corresponding holes of "Top Shell" and "Connector Card Assembly".
 - Connector Assembly Connector Shell (Top Shell) Connector Card Assembly (Connector Card Assembly.1)
 - Connector Shell (Bottom Shell)

👖 Constraints

- Fix.1 (Connector Card Assembly.1)
- Coincidence.2 (Top Shell,Connector Card Assembly.1)
- Coincidence.3 (Top Shell,Connector Card Assembly.1) Applications

- Set an axial coincidence between corresponding holes of "Bottom Shell" and "Connector Card Assembly".
 - Constraints
 Fix.1 (Connector Card Assembly.1)
 Coincidence.2 (Top Shell,Connector Card Assembly.1)
 Coincidence.3 (Top Shell,Connector Card Assembly.1)
 Coincidence.4 (Battom Shell,Connector Card Assembly.1)
 Coincidence.5 (Battom Shell,Connector Card Assembly.1)



EXERCISE BOOK

Student Notes:

Do It Yourself (4/4)



You can compare your results with attached model : "CATASM_Connector_Assembly3.CATProduct"

- Move the "Top Shell" with the compass. The 'Update' icon is activated indicating that an assembly needs an update.
- Update the assembly by clicking on the 'Update' icon





Save the assembly as 'CATASM_Connector_Assembly3.CATProduct' using 'Save As' command.

Connector Housing

Step 3: Analyzing the Assembly



In this step you will perform clash analysis in the assembly using 'Compute Clash' command. **EXERCISE BOOK**



```
Do It Yourself (1/2)
              Product used: "CATASM_Connector_Assembly3.CATProduct"
         Compute clash between following components using 'Compute
      6
         Clash' command
            Launch 'Compute Clash' command
            Multi select "Connector Card Assembly" and "Top Shell"
            Click 'Apply'
                                                                                          Clash Detection
                                                                                                                                   ? X
       <u>Analyze Window H</u>elp
                                                                                            -Definition
                                       Connector Assembly
                                                                                           Clash
          Bill of Material...
                                     🔩 Connector Shell (Top Shell)
                                                                                            /Connector Assembly/Top Shell
                                        Connector Card Assembly (Connector Card Assembly.1)
       🐼 <u>U</u>pdate...
                                                                                            /Connector Assembly/Connector Card Assembly.1
                                      Connector Shell (Buttom Shell)
       🝳 Constraints...
                                     Lange Constraints
                                                                                           -Result
                                     -Applications
                                                                                            🛔 Clash
       👷 Degree(s) of freedom...
       Dependencies...
                                                                                                                      Apply 🥥 Cancel
         Mechanical Structure...
                                                                                                   'Red Light' in the Result
          Compute Clash.
                                                                                                   section indicates clash
                                                                                                                   Top Shell
                                          Connector Card
                                          Assembly
Copyright DASSAULT SYSTEMES
                                                                    'Red' areas in the assembly
                                                                    indicate clash
```

Do It Yourself (2/2)

	-	10		
	100			
10 A	2.6	2	14	
	1			
-	- 22	-6	÷.,	

You can compare your results with the attached model: "CATASM_Connector_Assembly4.CATProduct"

- Compute clash between following components using 'Compute Clash' command
 - "Connector Card Assembly"
 - Bottom Shell"



EXERCISE BOOK

Connector Assembly

Step 4: Fixing the clash



In this step, you will eliminate the clash between the components by editing one of the components in the context of the assembly. In this process you will:

- Hide components
- Edit part in 'Part Design' workbench.
- Show components
- Save the assembly



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Do It Yourself (1/4)



Product used: "CATASM Connector Assembly4.CATProduct"

Hide "Bottom Shell".



- 🔮 PartBody 🖶 🎇 Geometrical Set.2 🚯 Connector Card Assembly (Connector Card Assembly.1) Connector Shell (Bottom Shell)
 - Constraints Applications

EXERCISE BOOK

Student Notes:

Refer to Detailed Steps to see the details on how to edit part and create a pocket using Part Design workbench

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Pocket sketch





Do It Yourself (4/4)

1.3	100	1	
1.1	eS.		34.
116	10	-1	а.
		1	-

You can compare your results with the attached model : "CATASM_Connector_Assembly5.CATProduct"

- Save various components using 'Save Management'.
 - Save "CATASMConnector_Shell.CATPart" as "CATASMConnector_Shell_with_Pocket.CATPart"
 - Save root assembly as "CATASM_Connector_Assembly5.CATProduct"
 - Click on Propagate directory to ensure all documents are saved in same folder

State	Name	Location	Save
Modified	CATASM_Connector_Assembly5.CATProduct	C:\Documents and :	Save As
Modified Onen	CATASMConnector_Card_Assembly.CATProduct CATASMConnector_Shell_with_Pocket.CATPart	C:\Documents and C:\Documents and	Propagate directory
Dpen	CATASMConnector Card.CATPart	C:\Documents and	Reset
Open	CATASMConnector_Socket_Receptacle.CATPart	C:\Documents and :	
2.1			
attern Nam	e: * Apply Pattern		
attern Nam Unsaved F	ile(s) Left Enable independent sa	ves	

Connector Assembly

Step 5: Adding screws



In this step you will add and position the 'Connector Screw' in the "Connector Assembly".

You will then create a pattern of screw using an existing pattern.



EXERCISE BOOK



Student Notes: Do It Yourself (1/3) Documents used: "CATASM Connector Assembly5.CATProduct", "CATASMConnector Screw.CATPart" Insert "CATASMConnector Screw.CATPart" in "Connector Assembly" using 'Insert Existing Component'. Connector Assembly Connector Shell (Top Shell) 🔓 Connector Card Assembly (Connector Card Assembly.1) Connector Shell (Bottom Shell) 🏡 Connector Screw (Connector Screw.1) Constraints -Applications **Connector Screw** Position the "Connector Screw" by adding following assembly constraints: Coincidence constraint between the axis of the "Connector" Screw" and the axis of 'Hole.1' holes in the "Top Shell" Contact constraint between the bottom face of the "Connector Screw" head and the top face of the "Top Shell" Click on Update icon to update constraints 🤔 Coincidence.8 (Connector Screw.1,Top Shell) 🜮 Surface contact.9 (Connector Screw.1,Top Shell)



Do It Yourself (3/3)



You can compare your results with the attached model: "CATASM_Connector_Assembly5_end.CATProduct"

- Save the "Connector Assembly" as "CATASM_Connector_Assembly_5_end.CATProduct" using Save Management.
 - Use 'Propagate directory' to save all the files in same location



Student Notes:

Vice Assembly

You will practice concepts learned throughout the course, by building the master exercise and following the recommended process

- Vice Assembly : Presentation
- Vice Assembly (1): Creating the Structure
- Vice Assembly (2): Positioning Components
- Vice Assembly (3): Editing Parts
- Vice Assembly (4): Inserting Fitting Components from catalogs

```
Vice Assembly
Exercise Presentation
                                  🙆 _ Р2
      70 min
Objectives :
In this exercise you will build the Vice Assembly,
modify two of its components and insert
components from catalogs
In this exercise you will use :
    Product Structure Tools
    Assembly Constraints
    Compass
    Catalog Browser
    Part Design in Context
    Standard Tools
                                                               Vice Assembly
```

EXERCISE BOOK

Student Notes:

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Student Notes:

Design Intent: Vice Assembly





Vice Assembly

Step 1: Creating the Structure



In this step you will create and name a root assembly and its sub-assemblies, insert components, assign instance names, and save the assembly using save management.



```
    RotatingComponent (RotatingComponent.1)
    AxisAssembly (AxisAssembly.1)
    AxisNut (AxisNut.1)
    Axis (Axis.1)
    BigScrew (BigScrew.1)
    FixedComponent (FixedComponent.1)
    2ndStatic Jaw (2ndStatic Jaw.1)
    Static Jaw (Static Jaw.1)
    Jaw Holder Flange (Right Flange)
    Movable Jaw Holder (Movable Jaw Holder.1)
    Jaw Holder Flange (Left Flange)
    Movable Jaw (Movable Jaw.1)
```



EXERCISE BOOK



Student Notes:

Do It Yourself (2/3)

- Create a copy of "Jaw Holder Flange" in "Fixed Component"
- Set the instance names of the "Jaw Holder Flange" to "Right Flange" and "Left Flange".

```
    Vice Assembly
    RotatingComponent (RotatingComponent.1)
    AxisAssembly (AxisAssembly.1)
    AxisINut (AxisNut.1)
    Axis (Axis.1)
    BigScrew (BigScrew.1)
    FixedComponent (FixedComponent.1)
    FixedComponent (FixedComponent.1)
    Static Jaw (2ndStaticJaw.1)
    Static Jaw (Static Jaw.1)
    Jaw Holder Flange (Right Flange)
    Movable Jaw Holder (Movable Jaw Holder.1)
    Jaw Holder Flange (Left Flange)
    Movable Jaw (Movable Jaw.1)
```



Do It Yourself (3/3)

- Save the root assembly using Save Management in a new folder "Vice Assembly". Save the new CATProducts as follows:
 - "Vice Assembly as "CATASM_ViceAssembly_Step2.CATProduct"
 - * "RotatingComponent" as "CATASM_RotatingComponent.CATProduct"
 - "FixedComponent" as "CATASM_FixedComponent.CATProduct"

State	Name	Location	Action	Save
New	CATASM_ViceAssembly_Step2.CAT	E:VAdded_ExercisesWice_Assembly	Save	Save As
1ew	CATASM_RotatingComponent.CATP	E:\Added_Exercises\Vice_Assembly	Save	Propagate director
lew.	CATASM_FixedComponent.CATProd	E:VAdded_ExercisesWice_Assembly	Save -	r topagate directory
)pened	CATASM_MovableJaw.CATPart	E:\Added_Exercises\Vice_Assembly	Save	Reset
Opened	CATASM_AxisNut.CATPart	E:VAdded_ExercisesWice_Assembly	Save	
Opened	CATASM_Axis.CATPart	E:\Added_Exercises\Vice_Assembly	Save 🚺	
Opened	CATASM BigScrew.CATPart	E:VAdded Exercises/Vice Assembly	Save	and the second sec
Dpened	CATASM_MovableJawHolder.CATPart	E:\Added_Exercises\Vice_Assembly	Save	
Jpened	CATASM JawHolderFlange.CATPart	E:VAdded Exercises/Vice Assembly	Save	
Dpened	CATASM 2ndStaticJaw.CATPart	E:\Added Exercises\Vice Assembly	Save	
Dpened	CATASM_StaticJaw.CATPart	E:VAdded_ExercisesWice_Assembly	Save	ALC: NO
1			Þ	
Unsaved File(s)	Left 🗌 Enable	e independent saves		
-				🎱 OK 📔 🥥 Car

EXERCISE BOOK

Student Notes:

Vice Assembly

Step 2: Positioning Components



In this step you will create constraints to position components relative to each other in the correct active assemblies.




EXERCISE BOOK



EXERCISE BOOK



Student Notes:

Do It Yourself (4/6)

Set the Multi-constraint mode to 'Chain Mode', add Contact constraints between highlighted faces and update the assembly.

Save the "FixedComponent" product as "CATASM FixedComponent Step3.CATProduct"





Do It Yourself (5/6)

Unhide "RotatingComponent" and activate "Vice Assembly" Set the Multi-constraint mode to 'Default Mode' Hide "Left Flange" Add the following constraints and update the assembly: Coincidence constraint between the faces of the "Movable Jaw" and "Movable Jaw Holder" Coincidence constraint between the face of "Movable Jaw" and the edge of the "Movable Jaw Holder" Coincidence /ice Assembly Constraint 💫 RotatingComponent (RotatingComponent.1) FixedComponent (FixedComponent.1) Movable Jaw (Movable Jaw.1) Constraints 0 Coincidence.1 (Movable Jaw.1,FixedComponent.1) Coincidence.2 (Movable Jaw.1, FixedComponent.1) Applications Coincidence Constraint 0

EXERCISE BOOK

Student Notes:

Student Notes:

Do It Yourself (6/6) Unhide "Left Flange" Add the following constraints and update the assembly: Coincidence constraint between the axis the "BigScrew" and the axis of the hole in the "2ndStaticJaw" Contact constraint between the "BigScrew" and the "Movable Jaw" Vice Assembly RotatingComponent (RotatingComponent.1) FixedComponent (FixedComponent.1) -🏡 Movable Jaw (Movable Jaw.1) Constraints Coincidence.1 (Movable Jaw.1,FixedComponent.1) P Coincidence.2 (Movable Jaw.1,FixedComponent.1) Coincidence.3 (RotatingComponent 1, FixedComponent 1) * Surface contact.4 (RotatingComponent.1, Movable Jaw.1) Applications

8 3

Vice Assembly

Step 3: Editing parts



In this step you will design two parts in context of the assembly. You will create holes in the parts to accommodate fastening screws.



EXERCISE BOOK









Student Notes: Do It Yourself (4/5) 6 Set the view mode to 'Shading with edges' Create a sketch consisting of three points on the front face of "Static Jaw" 🚯 Vice Assembly Create 'Coincidence constraints' between each of these RotatingComponent (RotatingComponent.1) points and the holes in parts behind "Static Jaw" FixedComponent (FixedComponent.1) Rename the sketch as "Pattern Points" 2ndStaticJaw (2ndStaticJaw.1) Create a 'User Pattern' of the Counterbored Hole using Static Jaw (Static Jaw.1) 'Pattern Points' for positioning Static Jaw 📰 xy plane Save the "Static Jaw" as Yz plane "CATASM StaticJaw Step4.CATPart" zx plane PartBody Pad.1 D Hole.1 <mark>沙-UserPattern.1</mark> Pattern Points 😽 External References 🞉 Geometrical Set.1 Jaw Holder Flange (Right Flange) ser Pattern Definition ? × Movable Jaw Holder (Movable Jaw Holder.1) -Instances Jaw Holder Flange (Left Flange) Positions : Pattern Points - Constraints Eß Number : Copyright DASSAULT SYSTEMES Movable Jaw (Movable Jaw.1) Object to Pattern Constraints Object: Hole.1 Ö Applications Anchor: No selection Keep specifications Cancel Preview OK

Do It Yourself (5/5)

Activate "Vice_Assembly". Save the components as follows:

- "FixedComponent" as "CATASM_FixedComponent_Step4.CATProduct"
- "Vice Assembly" as "CATASM_ViceAssembly_Step4.CATProduct"

Vice Assembly





EXERCISE BOOK

Student Notes:

Vice Assembly

Step 4: Inserting Fitting Components



In this exercise you will insert fitting elements from a catalog and constrain them in the assembly using assembly constraints.



Student Notes: Do It Yourself (1/16) Parts used: "CATASM ViceAssembly Step4.CATProduct" Activate "FixedComponent" Hide "RotatingComponent" and "Movable Jaw" 숷 Vice Assembly RotatingComponent (RotatingComponent.1) Measure following distances and diameters and keep these FixedComponent (FixedComponent.1) measures: 2ndStaticJaw (2ndStaticJaw.1) Thickness of the '2ndStaticJaw' as "Thickness1" Static Jaw (Static Jaw.1) Diameter of hole in 'Movable Jaw Holder' as "Diameter1" 🛊 🔩 Jaw Holder Flange (Right Flange) (1.rehind wat eidevoM) rehind wat eidevoM Thickness of 'Static Jaw' as "Thickness2" 🗣 🎭 Jaw Holder Flange (Left Flange) Diameter of hole in 'Movable Jaw Holder' as "Diameter2" End Constraints Thickness of 'Right Flange' as "Thickness3" Movable Jaw (Movable Jaw.1) Constraints Diameter of hole in 'Movable Jaw Holder' as "Diameter3" -Applicatione Θ D=8mm D=8mm 50m 37mm Thickness1 Diameter1 Thickness2 **Diameter2** 24.042mm **Diameter3** Thickness3

Do It Yourself (2/16) Open the "ISO.Catalog" by clicking on the Catalog Browser Browse the 'Screws' chapter. Inside 'Screws', browse the "ISO 4762 HEXAGON SOCKET HEAD CAP SCREW". Catalog Browser:H:\V5R14SP04\intel_a\startup\compon... 😤 🗙 Catalog Browser:H:\V5R14SP04\intel_a\startup\components\MechanicalSt... ? × 🖸 🛅 📰 💕 - 🗈 🔳 🗃 Current: ISO Standards Current: Screws ISU_4028_GRADE_A_HEXAGUN_SULKET_SET_SURE Bolts ISO 4029 GRADE A HEXAGON SOCKET SET SCRE C Keys SO_4762_HEXAGON_SOCKET_HEAD_CAP_SCREW D Nuts ISO_4766_GRADE_A_SLOTTED_SET_SCREW_FLAT_I Pins ISO 7046 1 COUNTERSUNK FLAT HEAD SCREW Screws all all a ISO 70/6 2 COLINTERSLINK EVAT HEAD SCREW (4 AE Table>> AB Filter: Table>> Filter: Close Close Catalog Browser:H:\V5R14SP04\intel_a\startup\components\MechanicalStandardParts\ISO... ? 🗙 E
 E ISO_4762_HEXAGON_SOCKET_HEAD_CAP_SCREW Curren Ê * ISO 4762 SCREW M1.6x2.5 STEEL HEXAGON SOCKET HEAD CAP Expand the Catalog Browser window 4762 SCREW M1.6x3 STEEL HEXAGON SOCKET HEAD CAP by clicking on "Table" button 20 ISO 4762 SCREW M1.6x4 STEEL HEXAGON SOCKET HEAD CAP ISO 4762 SCREW M1.6x5 STEEL HEXAGON SOCKET HEAD CAP 1 Filter: <<Table PartNumber PartName Design... d dia I nom dk max 🔺 ISO 4762 SCREW M1.6x2.5 ST. ISO_4762_M1.6x2.5_STE. M1.6 1.6mm 2.5mm ISO_4762_M1.6x3_STEEL ISO 4762 SCREW M1.6x3 STE ... M1.6 1.6mm 3mm ISO 4762 SCREW M1.6x4 STE ... ISO 4762 M1.6x4 STEEL ... M1.6 1.6mm 4mm 3mm . Close

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Do It Yourself (3/16)

EXERCISE BOOK

Student Notes:

• • • • • • • •		4 5					
Length		+ 15mm			Basic		
Diamete	er = "Diameter1"				PartNumber	Unset	
					PartName	Unset	
•					Designation	Unset	
Filter:		<u> </u>	E Table>>		d_dia	== 💌 8mm	
PartNumber	PartName	Designation d	Ldia Lnom 🔺		L_nom	>= 💽 65mm	
2 ISO 4762 SCREW N	41.6x3 ISO_4762_M1.6x2.5_5 41.6x3 ISO_4762_M1.6x3_ST	M1.6 1	.6mm 2.5mm		dk_max	Unset	
3 ISO 4762 SCREW №	41.6x4 ISO_4762_M1.6x4_ST	м1.6 1	.5mm 4mm <mark>.</mark> ▼		k þead depth	max 💽 Unset	
ac fa			Close				
					-		у 🥥
Filter: [(x."d_dia"==8mm	ide "FixedCompo)AND (x."I_nom">=65mm)	onent"					
Filter: (x."d_dia"==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW	AND (x."L_nom">=65mm) AND (x."L_nom") AND		PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	<pre>Karrier Content of Content o</pre>			
Double clic insert it ins Filter: [x."d_dia"==8mm PartNumber I ISO 4762 SCREW I ISO 4762 SCREW I ISO 4762 SCREW I	AND (x."L_nom">=65mm) AND (x."L_nom">=65mm) M8x65 STEEL HEXAGON SO M8x70 STEEL HEXAGON SO M8x80 STEEL HEXAGON SO		PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	IBx65_STEEL 18x70_STEEL 18x80_STEEL			
Double clic insert it ins Filter: [x.''d_dia''==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."I_nom">=65mm) AND (x."I_nom") AND (x."I_nom")		PartName PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	ISX65_STEEL ISX70_STEEL ISX80_STEEL ISX80_STEEL			
Double clic insert it ins Filter: [x."d_dia"==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."[_nom">=65mm) AND (x."[_nom"]>=65mm) AND (x."[]>=65mm) AND (x."[]>=65m	ICKET HEAD C	PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	ISK65_STEEL 18x65_STEEL 18x80_STEEL	011 30		
Double clic insert it ins Filter: [x."d_dia"==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."Lnom">=65mm) AND (x."Lnom">=65mm) / M8x65 STEEL HEXAGON SO / M8x70 STEEL HEXAGON SO / M8x80 STEEL HEXAGON SO		AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	IBx65_STEEL I8x65_STEEL I8x70_STEEL I8x80_STEEL			
Double clic insert it ins Filter: [x."d_dia"==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."[_nom">=65mm) AND (x."[_nom"]>=65mm) AND (x."[_nom"]>=65mm		PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	ISK65_STEEL 18x65_STEEL 18x70_STEEL 18x80_STEEL			
Double clic insert it ins Filter: [x."d_dia"==8mr PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."Lnom">=65mm) AND (x."Lnom">=65mm) / M8x65 STEEL HEXAGON SO / M8x70 STEEL HEXAGON SO / M8x80 STEEL HEXAGON SO		PartName AP ISO_4762_N AP ISO_4762_N AP ISO_4762_N	IBx65_STEEL I8x65_STEEL I8x70_STEEL I8x80_STEEL			
Double clic insert it ins Filter: (x."d_dia"==8mm PartNumber 1 ISO 4762 SCREW 2 ISO 4762 SCREW 3 ISO 4762 SCREW 4	AND (x."L_nom">=65mm) AND (x."L_nom") AND (x."L_		8x70 STEE PartName AP ISO_4762_N AP ISO_4762_N	ISK65_STEEL 18x65_STEEL 18x80_STEEL 18x80_STEEL 18x80_STEEL			

EXERCISE BOOK

Student Notes:

Do It Yourself (4/16)

- Apply filter on the table to select the screw which respects the following condition:
 - Length >= "Thickness2" + 15mm
 - Diameter = "Diameter2"
- Double click on "ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP" to insert it inside "FixedComponent"

Filter: [x.''d_dia''==8mm) AND (x.''l_nom''>=52mm)	H I	< <table< th=""></table<>
PartNumber	PartName	Design 🔺
1 ISO 4762 SCREW M8x55 STEEL HEXAGON SOCKET HEAD CAP	ISO_4762_M8x55	M8
2 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP	ISO_4762_M8x60	M8
3 ISO 4762 SCREW M8x65 STEEL HEXAGON SOCKET HEAD CAP	ISO_4762_M8x65	мв 🔤
4 ISO 4762 SCREW M8x70 STEEL HEXAGON SOCKET HEAD CAP	ISO 4762 M8x70	мв 🔟
•		▶



- Length >= "Thickness3" + 15mm
- Diameter = "Diameter3"
- Double click on "ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP" to insert it inside "FixedComponent"

Filter: (x."d_dia"==10mm) AND (x."l_nom">=39.042mm) **A** E <<Table PartNumber PartName Designation ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP ISO 4762 M10x40 ST M10 ISO 4762 SCREW M10x45 STEEL HEXAGON SOCKET HEAD CAP ISO 4762 M10x45 ST... M10 3 ISO 4762 SCREW M10x50 STEEL HEXAGON SOCKET HEAD CAP ISO_4762_M10x50_ST... M10 ISO 4762 SCREW M10x55 STEEL HEXAGON SOCKET HEAD CAP ISO_4762_M10x55_ST... M10



Do It Yourself (5/16)

- Hide all the measures
- Move the screws and position them roughly as shown



Student Notes:

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Student Notes:



EXERCISE BOOK



Student Notes: Instantiate multiple instances of the screw "ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP" in "FixedComponent" using 'Reuse Pattern' Use the 'UserPattern.1' in 'Static Jaw' as pattern for instantiation Reuse all detected constraints during instantiation Instantiation on a pattern ? X FixedComponent (FixedComponent.1) Keep Link with the pattern 2ndStaticJaw (2ndStaticJaw.1) Name: 🚵 Static Jaw (Static Jaw.1) Generated components' position with respect to: O pattern's definition 🔞 Static Jaw generated constraints 📰 xy plane Pattern 📖 yz plane UserPattern 1 Instance(s): 🛲 zx plane In component: Static Jaw (Static Jaw.1) 🐨 PartBody Component to instantiate - 🕖 Pad. 1 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKE C 0 Hole.1 First instance on pattern (0) re-use the original component - UserPattern.1 - Re-use Constraints External References Constraint Name Second Component Geometrical Set.1 Surface contact.25 Static Jaw (Static Ja. Coincidence 24 Static Jaw (Static Ja. Jaw Holder Flange (Right Flange) All Clear Put new instances in a flexible component OK Apply Close



EXERCISE BOOK

Student Notes:



SYSTEMES

EXERCISE BOOK



Student Notes:



SYSTEMES

Do It Yourself (14/16)

Save assembly 'FixedComponent'

Vice Assembly RotatingComponent (RotatingComponent.1) FixedComponent (FixedComponent.1) 🚽 2ndStaticJaw (2ndStaticJaw. 1) 🐜 Static Jaw (Static Jaw.1) Jaw Holder Flange (Right Flange) Movable Jaw Holder (Movable Jaw Holder.1) Jaw Holder Flange (Left Flange) 🔜 ISO 4762 SCREW M8x70 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x7 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x6) ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 🔜 ISO 4762 SCREW M8x70 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x7) ISO 4762 SCREW M8x70 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x7) ISO 4762 SCREW M8x70 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x7) 🔜 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x8 🔜 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x8 ISO 4762 SCREW M8x60 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M8x6 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 ISO 4762 SCREW M10x40 STEEL HEXAGON SOCKET HEAD CAP (ISO 4762 SCREW M10 Constraints Assembly features



EXERCISE BOOK

EXERCISE BOOK



Student Notes:

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Do It Yourself (16/16)

- Unhide "FixedComponent" and "Movable Jaw"
- Hide all constraints
- Save the final assembly as "CATASM_ViceAssembly_Step4_end.CATProduct" and "ORR-14-1"



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Flexible Assemblies

You will practice concepts learned throughout the course, by building the master exercise and following the recommended process

Flexible Assemblies : Presentation
 Flexible Assemblies (1): Assembling Components
 Flexible Assemblies (2): Constrain Full Assembly

Flexible Assemblies (3): Change Configuration

Student Notes:

Flexible Assemblies

Exercise Presentation



Objectives : In this exercise you will build the Full Assembly and use Flexible / Rigid sub-assemblies.

In this exercise you will use :

- Product Structure Tools
- Assembly Constraints
- Flexible / Rigid sub assemblies command



Design Intent: Flexible Assemblies

In this exercise you will:

- Insert following parts to create an assembly
 - "CATASM_Sub_clamp.CATProduct"
 - "CATASM_Clamp_Pad.CATPart"
- Duplicate sub-assembly 'sub-clamp'
- Constrain inserted sub assemblies and parts
- Use 'Flexible/Rigid' function to have different configurations of the sub-assembly





Student Notes:

Flexible Assemblies

Step 1: Assembling Components



In this step you will create and name an assembly, insert components, duplicate sub assembly and save the full assembly.



EXERCISE BOOK

Student Notes:

Do It Yourself



Documents used: "CATASM_Sub_Clamp.CATProduct", "CATASM_Clamp_Pad.CATPart"

- Create a new product and name it as "Clamp Assembly"
- Insert following components in "Clamp Assembly":
 - "CATASM_Sub_Clamp.CATProduct"
 - "CATASM_Clamp_Pad.CATPart"
- Duplicate the "sub-clamp" in "Clamp Assembly" by using Copy / Paste commands
- Using 'Save Management', save the root assembly as "CATASM_Clamp_Assembly_Step2.CATProduct" in your working folder and use 'Propagate directory' to save all documents in same location





Flexible Assemblies

Step 2: Constrain Clamp Assembly



In this step you will constrain the Clamp assembly using assembly constraints.



EXERCISE BOOK


Flexible Assemblies

Step 3: Change configuration



In this step with 'Flexible/Rigid' command, you will simulate two configurations for the subclamp assembly.

First configuration:'Open' (value=60 mm) Second configuration:'Close' (value=72.7 mm)



EXERCISE BOOK

EXERCISE BOOK

Student Notes:

Do It Yourself Parts used: "CATASM Clamp Assembly Step3.CATProduct" Make 'sub-clamp.2' flexible by using 'Flexible/Rigid Sub Assembly' command Notice the changes in the icon representing sub-clamp.2 A purple gear appears in this icon which indicates that the sub assembly is flexible. sub-clamp.2 object Edit Coer in New Wirdow Clamp Assembly Components Activate / Deactivate Component 💫 sub-clamp (sub-clam Representations 🎭 clamp-pad (clamp-pa **Component Constraints** Selection Mode 🖏 sub-clamp (sub-clam 🐨 Component Degrees Of Freecom Constraints Ja Ex F 🛺 Fix 1 (clamp-pad.1) Texible/Rigic Sub-Assembly Surface contact 2 (clamp-pad. 1, sub-cla 😤 Parallelism.3 (clamp-pad.1.sub-clamp.1auChange the value of 'Offset.10.1' under 'sub-clamp.2' to 60 mm. Now, the two instances of same sub-assembly are different configurations in the same assembly. Save the assembly as "CATASM Clamp Assembly Step3 end.CATProduct"



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You can compare your result with the attached model : "CATASM Clamp Assembly Step3 end.CATProduct"



Student Notes:

PC Speaker Assembly Exercise Now let us practice creating a PC Speaker assembly. PC Speaker Assembly Presentation Step 1: Preparing the Session Step 2: Creating the Product Structure Step 3: Positioning the Components Step 4: Analyzing Assembly **Step 5: Design in Context** Step 6: Replacing Components Step 7: Managing Structure

Exercise Presentation



In this exercise, you will create an assembly of a Desktop Personal Computer Speaker.

This Assembly Design process will cover the following topics:

- Inserting and positioning components
- Assembly constraints
- Assembly Analysis
- Design in context
- Reordering product structure
- Generate CATPart from CATProduct





Design Intent – PC Speaker (1/2)

Your first step will be to create the PC Speaker assembly progressively by using various assembly design tools. Then, with the help of different analysis tools, you will check your final assembly for minimum distance and components' clearance.

In the next step, you will modify a component that does not respect the specified clearance.

In the next step of the process, you will deal with a product enhancement request by inserting a Power LED Indicator and designing the Front Cover in the context of this part.

A design constraint will force you to change the location of the newly inserted component.





Student Notes:

Design Intent – PC Speaker (2/2)

Next, you will deal with the versioning aspect of Product Lifecycle Management:

A new component version has been created and needs to replace its older representation in the assembly. At this stage, you will have to manage the impact on the different component constraint links.

In the final step, you will use Assembly Design Tools to manage your product in terms of Visualization and Release.





- Feet_arm (Feet_arm.1)
- + stop_washer (stop_washer.1)
- 💠 🎭 stop_washer (stop_washer.2)

🎪 P(C Speaker Assembly_AllCATPart	
	×y plane	
	yz plane	
	zx plane	
	PartBody	
†-93	Front_Cover.1\PartBody	
†- <u>88</u>	Back_Cover.1\Body2	
† -🍪	Speaker_Assembly.1\Bass_Speaker.1\Outer_Frame	



PC Speaker Assembly

Step 1: Preparing the Session



In this step, you will prepare the CATIA session for the PC Speaker Assembly Exercise.

Options	? ×
Parameters and M Devices and Virtu	Cache Management Cgr Management ENOVIAvpm Nodes Customization Produces Cache Activation
A Product Structure A Product Structure A Material Library Catalog Editor	Cache Location Path to the local cache Path to the released cache

EXERCISE BOOK

Do It Yourself (1/3)

In this step, you will prepare the CATIA session necessary for replaying the entire exercise.

Cache Management : Activate "Work with the cache system"



Activate the "Keep link with selected object" option



Student Notes:

Do It Yourself (2/3)

For Assembly Design, activate the options "Manual Update" and "Automatic switch to Design mode"

Options						
Real Tir	ne Rendering	General	Constraints	DMU Clash - Pro	ocess I	DMU Sectioning
- © Part Ini	rastructure	Update) Automatic 🔮	Manual		-
	otations Infrastr	Update prop	agation depth			.
	ration Infrastruc	Compute ex) Active level	a All the levels		-
Mechanica	Design	C)Automatic 🧶	Manual		
- 69 Assemb	ly Design	Access to ge	eometry			+
- Sketche	er	9	Automatic swi	tch to Design mod	le	

Do It Yourself (3/3)		Stud
 Customize Visualization settings as shown: 	Lines and points	
	 All points No vertices Colored edges from faces 	
	Line-on-line	
	Gouraud Material	
	Triangles Transparent Hidden edges and points	
	Dynamic hidden line removal Options Rendering style per object	

PC Speaker Assembly

Step 2: Creating the Product Structure



In this step, you will create the product structure of the PC Speaker Assembly by inserting existing components.

PC Speaker Assembly
 Back_Cover (Back_Cover.1)
 Front_Cover (Front_Cover.1)
 Speaker_Assembly (Speaker_Assembly.1)
 Speaker_Stand (Speaker_Stand.1)
 Cover_Screws (Cover_Screws.1)
 Switch (Switch.1)
 Applications



EXERCISE BOOK

```
Do It Yourself (1/3)
    Load document "CATASM PC Speaker Assembly CATPArts.CATProduct".
   Create a new CATProduct "PC Speaker Assembly"
   Save this CATProduct as "CATASM PC Speaker Assembly Step1.CATProduct"
   Insert existing components from
   "CATASM_PC_Speaker_Assembly_CATParts.CATProduct": "Front_Cover.CATPart"
   and "Back Cover.CATPart"
   Insert new products 'Speaker Assembly' and 'Speaker Stand'
   Insert new Component 'Cover Screws'
  PC Speaker Assembly
                                                 💫 PC Speaker Assembly
   - Front_Cover (Front_Cover.1)
                                                   Service (Front Cover (Front Cover.1)
     Back Cover (Back Cover.1)
                                                      Back Cover (Back_Cover.1)
     Speaker_Assembly (Speaker_Assembly.1)
                                                      Speaker Assembly (Speaker Assembly.1)
    🔩 Speaker Stand (Speaker Stand.1)
                                                      Bass Speaker (Bass Speaker.1)
    🎭 Cover Screws (Cover Screws.1)
                                                     🖦 Medium Speaker (Medium Speaker.1)
    Applications
                                                     🛰 Bot Speaker Cover(Bot Speaker Cover.1)
                                                     🔩 Top Speaker Cover(Top Speaker Cover.1)
                                                     Electronic (Electronic.1)
    Activate the sub-assembly
                                                     Electronic_Support (Electronic_Support.1)
    'Speaker Assembly' and create the
                                                     Spk Assembly Screws (Spk Assembly Screws.1)
    product structure as shown by inserting
                                                     Screws.1) Elec Assembly Screws (Elec Assembly Screws.1)
    existing parts and creating new
                                                     Switch Connector (Switch Connector.1)
    components
                                                    Switch Connector (Switch Connector.2)
                                                    💁 Speaker Stand (Speaker Stand.1)
                                                   Cover Screws (Cover Screws.1)
                                                   Applications
```

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EXERCISE BOO

Do It Yourself (2/3)

EXERCISE BOOK

Student Notes:

Activate the sub-assembly Ê. 'Speaker Stand' and create the product structure as shown by inserting existing parts from "CATASM PC Speaker Assembly C **ATParts.CATProduct**". Instantiate multiple instances of the washers in the 'Speaker Stand' by using copy/paste

PC Speaker Assembly Front Cover (Front Cover.1) Back Cover (Back Cover.1) Speaker Assembly (Speaker Assembly.1) Speaker Stand (Speaker Stand.1) stop_washer (stop_washer.1) Feet support (Feet support.1) flat washer (flat washer.1) spring washer (spring washer.1) Feet_arm (Feet_arm.1) stop washer(stop washer.2) flat_washer (flat_washer.2) flat_washer (flat_washer.3) 🖶 🎭 spring_washer (spring_washer.2) Cover_Screws (Cover_Screws.1) Applications

Student Notes:

Do It Yourself (3/3)

- Activate root assembly and insert "Switch.CATPart" from "CATASM_PC_Speaker_Assembly_CATParts.CATProduct" in the root product.
 - PC Speaker Assembly
 - 📲 🎭 Front_Cover (Front_Cover.1)
 - F 🎭 Back Cover (Back Cover.1)
 - 🛉 執 Speaker_Assembly (Speaker_Assembly.1)
 - 🛰 Speaker_Stand (Speaker_Stand.1)
 - Cover_Screws (Cover_Screws.1)
 - 📲 🆣 Switch (Switch.1)
 - -Applications



- Save the following CATProducts using Save Management (use propagate directory)
 - Save "CATASM_PC_Speaker_Assembly_Step1.CATProduct" as "CATASM_PC_Speaker_Assembly_Step2.CATProduct
 - Save new product 'Speaker_Assembly' as "CATASM_Speaker_Assembly_Step2.CATProduct"
 - Save new product 'Speaker_Stand' as "CATASM_Speaker_Stand_Step2.CATProduct"

PC Speaker Assembly

Step 3: Positioning the components



In this step, you will roughly position components using positioning tools. You will then position the components permanently by applying various assembly constraints.





Do It Yourself (1/22)



Product used: CATASM_PC_Speaker_Assembly_Step2.CATPart

Hide the following components:

- Front_Cover.1' and 'Back_Cover.1'
- Speaker_Assembly.1' and 'Switch.1'
- Activate 'Speaker_Stand' product and fix 'Feet_support.1'
- Position various components in the 'Speaker_Stand' sub assembly using 'Snap' and 'Compass'
- Position the 'Feet_arm.1' using following assembly constraints:
 - Surface contact constraint between the two faces
 - Coincidence constraint between the axes of two cylindrical faces







EXERCISE BOOK

Student Notes:

EXERCISE BOOK

Student Notes:

Do It Yourself (2/22)

- Position 'spring_washer.1' using following constraints:
 - Coincidence constraint between the axes of the 'spring_washer.1' and the 'Feet_support.1'
 - Coincidence constraint between the xy plane of the 'spring_washer.1' and highlighted face of the 'Feet_arm.1'
 - Coincidence constraint between the yz plane of the 'spring_washer.1' and 'Plane.1' of 'Feet_arm.1'





EXERCISE BOOK

Student Notes:

Do It Yourself (3/22)

- Position 'flat_washer.1' using following constraints:
 - Coincidence constraint between the axes of the 'flat_washer.1' and the 'Feet_support.1'
 - Coincidence constraint between the face of the 'flat_washer.1' and 'Plane.1' of the 'spring_washer.1'

- Position 'stop_washer.1' using following constraints:
 - Coincidence constraint between the axes of the 'stop_washer.1' and the 'Feet_support.1'
 - Coincidence constraint between the xy plane of the 'stop_washer.1'and the face of the 'flat_washer.1'





Do It Yourself (4/22)

- Activate root product, and make the sub assembly 'Speaker_Stand.1' flexible
 Elevible/Bigid Sub-Assembly
- Unhide and position 'Back_Cover.1' roughly as shown
- Position 'Back_Cover.1' permanently using following constraints:
 - Coincidence constraint between the axes of the 'Back_Cover.1' and the 'feet_arm.1'
 - Surface contact constraint between the spherical surfaces of the 'Back_Cover.1' and the 'feet_arm.1'

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EXERCISE BOOK

Do It Yourself (5/22)

- Activate 'Speaker_Stand' product and position 'flat_washer.2' using following constraints:
 - Coincidence constraint between the axes of the 'flat_washer.2' and the 'Feet_arm.1'
 - Surface contact constraint between the faces of the 'flat_washer.2' and 'Back_Cover.1'



- Position 'spring_washer.2' using following constraints:
 - Coincidence constraint between the axes of the 'spring_washer.2' and the 'flat_washer.2'
 - Coincidence constraint between the xy plane of the 'spring_washer.2' and the face of 'flat_washer.2'

EXERCISE BOOK

1

Do It Yourself (6/22)

'Feet arm.1'

Position 'flat washer.3' using following constraints:

EXERCISE BOOK

Coincidence constraint between the axes of the 'flat washer.3' and the

Student Notes:

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EXERCISE BOOK

Student Notes:

Do It Yourself (7/22)

Activate root product, unhide and make the sub assembly 'Speaker_Assembly.1' flexible

Elexible/Rigid Sub-Assembly

- Position 'Electronic_Support.1' roughly as shown -
- Position Electronic_Support.1' permanently using following constraints:
 - Coincidence constraint between the axes of the first screw hole of the 'Electronic_Support.1' and the corresponding hole in the 'Back_Cover.1'
 - Coincidence constraint between the axes of the second screw hole of the 'Electronic_Support.1' and the corresponding hole in the 'Back Cover.1'
 - Surface Contact constraint between the faces of the 'Electronic_Support.1' and the 'Back_Cover.1'





Student Notes:

Do It Yourself (8/22)

- Activate 'Speaker_Assembly.1' and position 'Electronic.1' roughly as shown
- Position 'Electronic.1' permanently using following constraints:
 - Coincidence constraint between the axes of the first screw hole of the 'Electronic_Support.1' and the corresponding hole in the 'Back_Cover.1'
 - Coincidence constraint between the axes of the second screw hole of the 'Electronic_Support.1' and the corresponding hole in the 'Back_Cover.1'
 - Surface Contact constraint between the faces of the 'Electronic_Support.1' and the 'Back_Cover.1'











EXERCISE BOOK

Student Notes:

Do It Yourself (9/22)

- Activate the root assembly, unhide 'Front_Cover.1' and position it approximately as shown
- Position 'Front_Cover.1' permanently using following constraints:
 - Coincidence constraint between the axes of the adjacent curvilinear surfaces of 'Front_Cover.1' and 'Back_Cover.1'
 - Coincidence constraint between the axes of another set of adjacent curvilinear surfaces of 'Front_Cover.1' and 'Back_Cover.1'
 - Surface Contact constraint between the faces of the 'Front_Cover.1' and the 'Back_Cover.1'







EXERCISE BOOK

Student Notes:

Do It Yourself (10/22)

- Hide 'Back_Cover.1' and position 'Bass_Speaker.1' approximately as shown
- Position 'Bass_Speaker.1' permanently using following constraints:
 - Surface Contact constraint between the faces of the 'Bass_Speaker.1' and the 'Front_Cover.1'
 - Coincidence constraint between the axes of the 'Bass_Speaker.1' and the circular opening in 'Front_Cover.1'
 - Coincidence constraint between the axes of screw holes in the 'Bass_Speaker.1' and 'Front_Cover.1'











Do It Yourself (11/22)

- Hide 'Speaker_Stand.1', 'Electronic.1' and 'Electric_Support.1'
- Position 'Medium_Speaker.1' permanently using following constraints:
 - Surface Contact constraint between the faces of the 'Medium_Speaker.1' and the 'Front_Cover.1'
 - Coincidence constraint between the axes of the 'Medium_Speaker.1' and the circular opening in 'Front_Cover.1'
 - Coincidence constraint between the axes of screw holes in the 'Medium_Speaker.1' and 'Front_Cover.1'





Do It Yourself (12/22)

- Position 'Top_Speaker_Cover.1' permanently using following constraints:
 - Coincidence constraint between the axes of the 'Top_Speaker_Cover.1' and the 'Front_Cover.1'
 - Coincidence constraint between the yz planes of the 'Top_Speaker_Cover.1' and the 'Front_Cover.1'
 - Surface Contact constraint between the faces of the 'Top_Speaker_Cover.1' and the 'Front_Cover.1'









Select this face of 'Front_Cover.1' for surface contact constraint

Student Notes:

Do It Yourself (13/22)

- Position 'Bot_Speaker_Cover.1' permanently using following constraints:
 - Coincidence constraint between the axes of the 'Bot_Speaker_Cover.1' and the 'Front_Cover.1'
 - Coincidence constraint between the yz planes of the 'Bot_Speaker_Cover.1' and the 'Front_Cover.1'
 - Surface Contact constraint between the faces of the 'Bot_Speaker_Cover.1' and the 'Front_Cover.1'



(0)

Unhide 'Electronic.1' and 'Electric_Support.1'

Do It Yourself (14/22)

- Position 'Switch_Connector.1' permanently using following constraints:
 - Coincidence constraint between the axes of the 'Switch_Connector.1' and the circular cutout in the 'Front_Cover.1'
 - Surface Contact constraint between the side faces of the 'Switch_Connector.1' and the 'Front_Cover.1'
 - Surface Contact constraint between the bottom face of the 'Switch_Connector.1' and the inner face of the 'Front_Cover.1'





- Similarly position 'Switch_Connector.2' permanently using following constraints:
 - Coincidence constraint between the axes of the 'Switch_Connector.2' and the circular cutout in the 'Front_Cover.1'
 - Surface Contact constraint between the side faces of the 'Switch_Connector.2' and the 'Front_Cover.1'
 - Surface Contact constraint between the bottom face of the 'Switch_Connector.2' and the inner face of the 'Front_Cover.1'



EXERCISE BOOK

Student Notes:

Do It Yourself (15/22)

- Unhide 'Switch.1' and add its another instance
- Position approximately the two instances as shown -
- Position 'Switch.1' and 'Switch.2' permanently using following constraints:
 - Surface Contact constraint between the inner semi-circular groove of the 'Switch' and the shaft of the 'Switch_Connector'
 - Surface Contact constraint between the inner face of the 'Switch' and the top face of the shaft of 'Switch_Connector'







EXERCISE BOOK <u>Student Notes:</u> Spk_Assembly_Screws (Spk_Assembly_Screws.1)

Part used: "Spk_screw.CATPart"

Do It Yourself (16/22)

- Activate 'Speaker_Assembly.1' and insert 'Spk_screw.CATPart' in the component 'Spk_Assembly_Screws.1'
- Instantiate 'Spk_screw' to create total 6 instances of this screw
- Make the sub assembly 'Spk_Assembly_Screws.1' flexible
- Using multi-constraints mode, position all instances of the 'Spk_screw' with the following constraints:
 - Coincidence constraint between the axes of the 'Spk_Screw' and the screw hole in the 'Bass_Speaker.1'
 - Contact constraint between the faces of the 'Spk_Screw' and the 'Bass_Speaker.1'
 - Coincidence constraint between the axes of the 'Spk_Screw' and the screw hole in the 'Medium Speaker.1'
 - Contact constraint between the faces of the 'Spk_Screw' and the 'Medium_Speaker.1'





EXERCISE BOOK

Student Notes:

Do It Yourself (17/22)



Parts used: "Elec_screw_1.CATPart", "Elec_screw_2.CATPart"

- Activate 'Speaker_Assembly.1' and insert 'Elec_screw_1.CATPart' and 'Elec_screw_2.CATPart' in the component 'Elec_Assembly_Screws.1'
- Instantiate 'Elec_screw_1' and 'Elec_screw_2' to create two instances of each of screws
- Make the sub-assembly 'Elec_Assembly_Screws.1' flexible
- Hide 'Front_Cover.1' and unhide 'Back_Cover.1'
- Position the two instances of the 'Elec_screw_1' with the following constraints:
 - Coincidence constraint between the axes of the 'Elec_screw_1' and the screw hole in the 'Electronic_Support.1'
 - Contact constraint between the faces of the 'Elec_screw_1' and the 'Electronic_Support.1'
- Position the two instances of the 'Elec_screw_2' with the following constraints:
 - Coincidence constraint between the axes of the 'Elec_screw_2' and the screw hole in the 'Electronic.1'
 - Contact constraint between the faces of the 'Elec_screw_2' and the 'Electronic.1'







EXERCISE BOOK

Student Notes:

Do It Yourself (18/22)



Part used: "Housing_screw.CATPart"

- Activate root assembly and unhide 'Front_Cover.1'
- Insert 'Housing_screw.CATPart' in 'Cover_Screws' and instantiate multiple instances to create total four instances
- Make the sub-assembly 'Cover_Screws.1' flexible
- Position the four instances of the 'Housing_screw' with the following constraints:
 - Coincidence constraint between the axes of the 'Housing_screw' and the screw hole in the 'Back_Cover.1'
 - Surface Contact constraint between the faces of the 'Housing_screw' and the in the 'Back Cover.1'
- Unhide 'Speaker_Stand.1'





Student Notes:

Do It Yourself (19/22)

You will now demonstrate the PC Speaker can be rotated in the yz and zx plane

- Activate 'Speaker Stand.1', create an angular constraint between the 'Plane.1' of 'Feet arm.1' and xy plane of 'Feet support.1' with angle between the two planes set as '0 deg', re-activate root assembly and update the assembly.
- Change the value of this angular constraint to '-45deg' and update the assembly
- Observe the new orientation of the PC Speaker assembly and restore the angle to '0deg'



You can add preset values for the rotation angle by using contextual menu "Add Multiple Values" and specify the values in the list.

Value 10deg

Secto 5deg

1

45deg

30deq

15dec

10deq

Odea

-5deg

10dea

20deg

30deg
Student Notes:

Do It Yourself (20/22)

- Activate the root assembly, create an angular constraint between the yz planes of the 'Feet_arm.1' and 'Back_Cover.1' with angle between the planes set to '0deg'
- Update the assembly
- Change the angle value for the newly created angle constraint to '45deg' and update the assembly
- Observe the new orientation of the PC Speaker assembly and restore the angle value to '0deg'



Do It Yourself (21/22)

EXERCISE BOOK

Student Notes:

Activate root assembly and group several constraints into sets as shown Create a set for each group of constraints between the pair of components Hide all constraints 🐜 Switch (Switch.1) 🐜 Switch (Switch.2) T Constrain Center graph T Constraints -Applications Reframe On T Back Cover Feet Arm 🛜 Hide/Show • Ø Coincidence.2 (Back Cover.1, Feet arm.1) 1) Surface contact.3 (Back Cover.1,Feet arm.1) Properties Alt+Enter 🔁 Ope<u>n</u> Sub-Tree TI Back Cover Flat Washer.2 💥 cug Ctrl+X 🥩 Coincidence.4 (flat_washer.2,Back_Cover.1) - 🗊 Surface contact.5 (flat_washer.2,Back_Cover.1) B COPY Chd+C 🔁 Paste • Ø Coincidence.6 (flat washer.2,Back Cover.1) Chrl+V. TI Electronic Support Back Cover Paste Special... Till Back_Cover_Front_Cover Delete Del TI Bass Speaker Front Cover Constr<u>a</u>nts object <u>A</u>dd Set T Medium_Speaker_Front_Cover Top_Speaker_Cover_Front_Cover Refresh Constraint Til Bot Speaker Cover Front Cover Time Switch Connector 1 Front Cover TY Switch Connector 2 Front Cover Time Switch_Switch_Connector_1 Copyright DASSAULT SYSTEMES Tousing_screw_Back_Cover Angle.55 (Feet_arm.1,Back_Cover.1) Applications

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Student Notes:

Do It Yourself (22/22)

Save the root assembly as "CATASM_PC_Speaker_Assembly_Step3.CATProduct" using propagate directory





PC Speaker Assembly

Step 4: Analyzing Assembly



In this step, you will analyze the design of the speaker assembly for minimum ground clearance and minimum distance between cover and speaker.

You will verify the rotational degree of freedom for volume control and bass control switches. You will extract a Bill of Material for PC Speaker Assembly





EXERCISE BOOK

Do It Yourself (1/5)



Product used: CATASM_PC_Speaker_Assembly_Step3.CATProduct

You will analyze the minimum ground clearance for a particular orientation of the speaker assembly and modify to design to maintain the minimum ground clearance above 10 mm. 22.5 °

Edit the angle constraint between 'Feet_arm.1' and 'Back_Cover.1' and change it to '22.5deg'

Angle .41 (Back_Cover .1, Feet_arm .1)

Edit 'Feet_support.1' and create a plane on the bottom surface as shown.



Measure 'Minimum' distance between the lower surface of the 'Back_Cover.1' and the newly created plane bottom surface of the 'Feet_support.1'. This distance is less than the design clearance of 10mm.

Note: Measured values are representative and not necessarily the exact values that will be seen by the user.



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EXERCISE BOOK

Student Notes:

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Student Notes:

Do It Yourself (3/5)

Hide 'Front_Cover.1' and compute the band analysis between the 'Back_Cover.1' and 'Bass_Speaker.1' for designed clearance of 10 mm



Note: Measured values are representative and not necessarily the exact values that will be seen by the user.

The clearance between the 'Bass_Speaker.1' and 'Back_Cover.1' is below the designed clearance band (10mm to 12 mm). In reality the assembly have to be modified.

Hide the Measure and Distance nodes

Unhide 'Front_Cover.1'

Bill Of Materia Quan F 1 E 1 N 1 E 1 T	ial Listing Report I It: Speaker_Assembly							
Bill of Materia Quan F 1 E 1 N 1 E 1 T	al: Speaker_Assembly Part Number				ā.			
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Total parts: 3	5					1	1	Speake
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Bill of M	aterial: PC Speaker #	Assembly	
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1	Back_Cover	Part	Î.
1	Speaker_Assembly	Assembly	1
1	Speaker_Stand	Assembly	1
1	Cover Screws	Assembly	1
2	Switch +	Part	l +

Student Notes:

Do It Yourself (5/5)

Verify the rotational degree of freedom of the Volume control and Bass control switches.

Degrees of Freedom Analysis					
- Analyzed Eler	nent / Contextual Pro	duct			
Switch.1 / PC S	peaker Assembly				
Degrees of Freedom					
Rotation_1					
Detailed Information					
Representation	п Туре	Vector			
Rotation_1		x=0,y=1,z=0			



Save the assembly as 'CATASM_PC_Speaker_Assembly_Step4.CATProduct using save management

PC Speaker Assembly

Step 5: Designing in Context



In this step, you will insert an existing CATPart with positioning. You will design the Front_Cover in context of the another part.



EXERCISE BOOK

Student Notes:

EXERCISE BOOK

Do It Yourself (1/4)



Product used: CATASM_PC_Speaker_Assembly_Step4.CATProduct

- Switch 'PC Speaker Assembly' to design mode
- Edit 'Front_Cover' and create a point on surface of the 'Front_Cover.1' as shown

Point Definition	<u>?×</u>
Point type: On surface	•
Surface: Pad.10\Face	
Direction: Components	
Distance: 44.836mm	
Reference	
Point: Default (Middle)	
Dynamic positioning	
Coarse O Fine	
🕒 OK 🥥 Gancel	Preview



The positioning of the point is approximate between the switch and circular opening in the cover

? ×

- 1

Preview

Create a plane tangent to the front face and passing through the point just created



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Student Notes: Do It Yourself (2/4) Part used: LED.CATPart Launch the CATPart "CATASM LED.CATPart" and save it in a temporary location (for example : C:\temp) Insert existing part "CATASM LED.CATPart" with positioning C Position the LED using points and planes as shown Smart Move ? X Component : LED.1 (\mathbf{o}) 0 × i i January Automatic constraint creation Fix Component More >> \odot \mathbf{O} 🔾 ОК art Move ? × 0.0Component : LED.1 0 0 Copyright DASSAULT SYSTEMES STATES OF × Ħ Automatic constraint creation LED positioned in PC Speaker Assembly ala Fix Component More >> **Э** ОК

EXERCISE BOOK

EXERCISE BOOK Student Notes: Do It Yourself (3/4) Create an 'Assembly Remove' feature using 'Drilling Tool' Ê PC Speaker Assembly body inside LED with part affected as 'Front Cover' - Front_Cover (Front_Cover.1) 🐀 LED (LED.1) 🔩 Back Cover(Back Cover.1) Speaker_Assembly (Speaker_Assembly.1) 🖮 🎪 LED ssembly Features Definition ? X 🔩 Speaker Stand (Speaker Stand.1) ' 🖉 xy plane Name: Assembly Remove. 🎭 Cover Screws (Cover Screws.1) Parts possibly affected 🧽 yz plane 🐀 Switch (Switch.1) Name Path zx plane Back_Cover PC Speaker Assembly\Back_Cover.1 Bass Speaker PC Speaker Assembly\Speaker Assembly._ 🛰 Switch (Switch 2) Medium Speaker PC Speaker Assembly\Speaker_Assembly. Bulb 2 Bot_Speaker_Cover PC Speaker Assembly\Speaker_Assembly. 🕂 🎭 LED (LED.1) Top_Speaker_Cover PC Speaker Assembly\Speaker_Assembly. 🗟 Holder Electronic PC Speaker Assembly\Speaker Assembly. Constraints PC Speaker Assembly\Speaker_Assembly. Electronic Support 🖓 Drilling Tool Elec_screw_1 PC Speaker Assembly\Speaker_Assembly. - 🥸 Assembly features Elec screw 1 PC Speaker Assembly\Speaker Assembly. Þ 🞇 Geometrical Set.1 Assembly Remove.1 $\geq \overline{\otimes}$ ⊻ - 🚵 Front_Cover.1Front_Cover/Remove. Affected parts Applications Path Name 3 PC Speaker Assembly\Front Cover.1 Front Cover • Highlight affected parts OK Grancel Remove ? × RemoveDrilling Tool After: PartBody ÖK Cancel Hide LED to see the assembly remove feature

Student Notes:

Do It Yourself (4/4) Modify the position of LED by editing the point of positioning plane in 'Front Cover.1' Point Definition ? × Point type: On surface - 10 \mathbf{O} Surface: Pad.10\Face.50 48.361 G 0 Direction: Components Distance: 48.361mm ۲ Reference Point: Default (Middle) Dynamic positioning O Fine Coarse Cancel Preview OK New position of plane in Front Cover LED Position updated after assembly update The positioning of point is approximate and you can position it as shown above Activate the root product and update the assembly. The Assembly Remove feature is automatically repositioned Save the assembly as 'CATASM PC Speaker Assembly Step5.CATProduct using save management

PC Speaker Assembly

Step 6: Replacing Components



In this step, you will replace an existing component in an assembly with another similar component and reconnect the broken constraints



EXERCISE BOOK



Student Notes: Do It Yourself (2/3) Analyze and reconnect broken constraints for the two instances of 0 replaced 'Switch'. **Constraints Analysis** ? X **Constraint Definition** ? X Constraint Type: Surface contact Name Surface contact.43 PC Speaker Assembly 4 B 8 - Supporting Elements Less(Type Component Degrees of freedom Constraints Broken Status Jnknown New_Switch (Switch. isconnected Active component PC Speaker Assembly Switch_Connector (Switch_Connector.2) Cylinder Connected Components 36 Reconnect. Not constrained 2 OK Cancel - Status Verified 85 Impossible 5 4 Not updated Broken Deactivated 0 1 Measure Mode ? × **Constraints Analysis** PC Speaker Assembly 2 • Switch Switch Connector 1 Degrees of freedom Constraints Broken Surface contact.29 (Switch Connector.1, Switch.1) Surface contact.43 (1) Surface contact.30 (Switch. 1, Switch_Connector. 1) Coincidence.42 (2) Surface contact.41 (3) Switch Switch Connector 2 Surface contact.40 (4) Surface contact.39 (5) Surface contact.31 (Switch.2, Switch Connector.2) Coincidence.38 (6) Surface contact.32 (Switch_Connector.2,Switch.2) Reconnecting broken constraints by using the "Reconnect" command

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EXERCISE BOOK

Do It Yourself (3/3)

- Update the assembly
- Save the root assembly using 'Save Management' as "CATASM_PC_Speaker_Assembly_Step6.CATProduct"





EXERCISE BOOK

PC Speaker Assembly

Step 7: Managing Product Structure



In this step, you will reorder existing product structure and propose a lighter representation of bought out parts (for example speakers) in order to reduce the size of the assembly.

Finally you will share the assembly model for review while protecting the design intent by generating a CATPart of the assembly



EXERCISE BOOK

Do It Yourself (1/3)



Product used: CATASM PC Speaker Assembly Step6.CATProduct

Reorder the product structure for better visualization of group of components in the specification tree as shown



Specification Tree after reordering the structure

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EXERCISE BOO



Applications

Design of assembly is visible and changes in the design can be made in the assembly Design of assembly is invisible and only assembly review (sectioning, measurement) can be done. No design changes are done here

Speaker_Assembly.1\Bot_Speaker_Cover.1\PartBody
\$\$ Speaker_Assembly.1\Top_Speaker_Cover.1\PartBody

Speaker Assembly.1\Electronic.1\Plate

Speaker_Assembly.1\Electronic.1\Cond

Do It Yourself (3/3)

- Save as "Bass_Speaker.CATPart" as "Bass_Speaker.cgr"
- Also save "Medium_Speaker.CATPart" as "Medium_Speaker.cgr"



Bass Speaker CATPart representation (Design mode representation) File size : 2519 Kb



Bass Speaker cgr representation (Simplified representation) File size : ~1340 Kb

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The file size of the simplified representation depends upon the CATIA settings for 'Cgr Management'.

You can replace these bought out components in session with their 'cgr representations'

to reduce the total assembly size.

If a cgr replacement is done then the 'product to part' will only partially work'.

EXERCISE BOOK