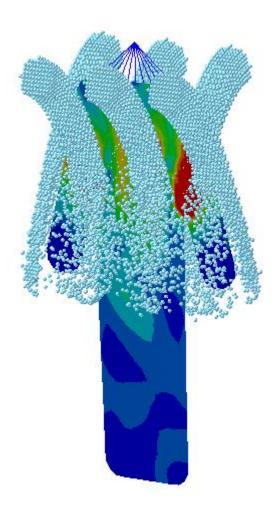


Styler (Flex – Particleworks)





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Edition Note

This document describes the release information of **RecurDyn V9R4**.

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Overview

This tutorial covers how to perform co-simulation between RecurDyn and Particleworks. In this tutorial, co-simulation is performed on the dynamic interaction between the flexible bodies of RecurDyn and the fluid particles of Particleworks.

The model that will be covered in this tutorial is the Styler mechanism. The Styler is used to shake off the dust attached to cloth and to remove its wrinkles with steam. This tutorial analyzes the dynamic interaction between the clothes, which is expressed as a flexible body, and the steam, which is expressed as particles. After the co-simulation, we will also check the stress formed as the particles touch the flexible body, using the Contour function of RecurDyn.

Task Objectives

This tutorial covers the following topics:

- How to export *.wall files of rigid and flexible bodies in a RecurDyn model
- How to create particles in Particleworks
- How to set fluid properties in Particleworks
- How to perform co-simulation in RecurDyn
- How to perform post-processing in RecurDyn

Prerequisites

- This tutorial is intended for users who have completed the basic tutorials provided with RecurDyn. If you have not completed these tutorials, then you should complete them before proceeding with this tutorial.
- Particleworks software must be installed to proceed with this tutorial. This tutorial was created based on Particleworks 6.2.0.
- In this tutorial, the analysis was carried out using the NVIDIA GeForce GTX TITAN graphics card. Depending on the specifications of the computer and the version of the software, there may be slight differences in the results of the analysis.

Tasks

This tutorial consists of the following tasks. The following table outlines the time required to complete each task.

(* The time required may vary depending on the specifications of the computer and the proficiency of the user.)

Task	Duration (minutes)
Registering Particleworks GUI on the RecurDyn Ribbon	10
Modifying a RecurDyn Model	10
Creating a Particleworks Model	15
Co-simulation	10
RecurDyn Post-processing	5
Total	50



Register Particleworks GUI in RecurDyn

By default, the **External SPI (Particleworks)** GUI is not visible in the **RecurDyn**. You must add the GUI to **RecurDyn** using the configuration XML file provided by **Particleworks**.

Task Objective

Learn how to register **External SPI(Particleworks)** tab in **RecurDyn** ribbon using the configuration XML and to set a particle solver DLL.



Copy Configuration XML

To copy Particleworks.xml:

Copy the **Particleworks.xml** from install path of **Particleworks** software.

• <Particleworks Install Path>\module\Particleworks.xml

To paste XML in RecurDyn:

Paste the **Particleworks.xml** copied above to **RecurDyn** install path.

• <RecurDyn Install Path>\Bin\Solver\CoSim\StdParticleInterface\Particleworks.xml

To confirm RecurDyn GUI:

Run RecurDyn and check a ribbon GUI, you can see the External SPI tab and there is a Particleworks group.

	D [🗎	🖹 🔥 🥎 -	ê - 🌷 🄞	. .							Recurl	Dyn V9R4 - [Mo
\sim	Home	SubEntity	Analysis	Professional	Flexible	Post Analysis	TSG	DriveTrain	CoLin	k AutoDesign	Communicator	External SPI
Wall	s Export	Settings	Connect	Contour	Sa S	-	Sensors	Animation	Clip	Contour		
	Part	cleworks				Post-	Process					

To check a path of particle solver DLL:

Must check where particle solver DLL file should be located.

- 1. From the **Paticleworks** group in the **External SPI** tab, click **Settings**.
- Settings
- 2. In the **Settings** dialog box, click the **Info**.

Info	×
Name	Particleworks
Developer	Prometech Software, Inc.
Description	A computational fluid dynamics solver based on Moving Particle Sim
DLL Path	C:\Prometech\Particleworks_6.2.0_181221\module\Particleworks.dll
Output	Output\rd_pw_%.8d

You can check the **DLL Path** in the **Info** dialog window. This path is set to the default installation location of Particleworks. So, if you installed Particleworks in a different path, you must modify the DLL path in the Configuration XML file.

Tip: Modifying the Particle Solver DLL path in Configuration XML file

(Perform it when the DLL path in the Info dialog window is different from the Particleworks installation path.)

- 1. Open the **Particleworks.xml** file.
- 2. Modify the DLL path following **<Path>** as shown below.

```
<?xml version="1.0"?>
 <!-- The first letters of names of elements are capitalized and names of attributes are w
 <!-- Any element for which support is optional must have the attribute "supported" with t
 <!-- If there are multiple supported options of an element, then the element can have an
 <!-- The names of elements in this file cannot be changed. -->
 <!-- Configuration : required -->
 <!-- Requires the attribute "type" and "version"-->
 <!-- The value of the attribute "type" must be "Embedded" or "Independent" -->
 <!-- External particle solvers should use 'type="Independent"'. -->
[]<Configuration type="Independent" version="1010">
     <!-- Details : requred -->
     <Details>
         <!-- Name : required -->
         <!-- This text will be used as the name of Ribbon Group icon in RecurDyn to ident
         <Name>Particleworks</Name>
         <!-- Developer : optional -->
         <Developer>Prometech Software, Inc.</Developer>
         < --- Description : optional -->
         <Description>A computational fluid dynamics solver based on Moving Particle Simul
         <!-- Path : required -->
          <!-- The path of the dll that RD will load to connect to the particle solver</p>
                                                                                        ->
         <Path>C:\Prometech\Particleworks_6.2.0_181221\module\Particleworks.dll</Path>
         21 OutputName + required >
```

- 3. Save the **Configuration XML** file.
- After confirming that the Configuration XML has been modified successfully, restart RecurDyn.



Modifying a RecurDyn Model

Task Objectives

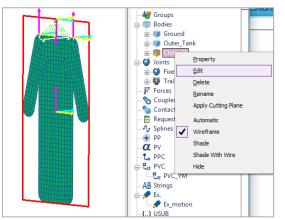
In this chapter, you will learn how to create a flexible wall for analysis and how to export the necessary files in Particleworks.



Defining a patch set

For co-simulation between flexible bodies and particles of Particleworks, the portion of the flexible body that contacts the particles must be defined as a patch set.

- 1. Open the **Styler_flex_model_cloth_start.rdyn** file that was provided as an example model for this tutorial.
- 2. Enter the Edit mode of the Cloth_FE body.

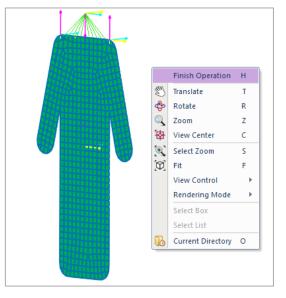




4. When the Patch Set dialog box appears, click the Add/Remove button.



- 5. Select all **patches** by **dragging** them, right-click the mouse, and click **Finish Operation**.
- 6. Click the **OK** button.
- 7. Exit the Edit mode.





Patch

Creating walls

Create walls for Outer_Tank and Cloth_FE.

- 1. In the **Particleworks** group of the **External SPI** tab, click **Walls**.
- 2. In the Working Window, click Outer_Tank.
- 3. Click Walls again, and click Cloth_FE.SetPatch1 in the Working Window.

Tip: You can select Cloth_FE by using **Select Box** or **Select List**, which are existing methods for selecting internal bodies. In this model, however, Outer_Tank is set as the layer 2 in a multi-layer. So, if you press "Ctrl + 2", which is a shortcut key combination for **Layer hide/show**, Outer_Tank will be hidden so that you can choose inner Cloth_FE more easily.

- 4. Modify the names of the walls as follows:
 - Wall1 → Wall_Outer_Tank
 - Wall2 → Wall_Cloth_FE

Exporting a *.wall file

- 1. In the **Particleworks** group of the **External SPI** tab, click **Export**.
- 2. When the **Export** dialog box appears, locate the folder you want to save the file to and click **OK** to save it.

The **rd_pw.wall** file and the **WallGeometries** folder are created in the saved folder. The files created in this chapter are moved to the **Particleworks** project folder in Chapter 4.

TIP: If you want to save the rd_pw.wall file somewhere else, you may do so. Pressing the Export button and clicking **OK** immediately saves the file in the default folder where the rdyn files are saved.

Note: The rd_pw.wall file contains information about the position and orientation of **wall geometries**. If you import this file into **Particleworks** later, several wall geometries are imported at once. In the Wall Geometries folder, the files (*.obj or *.stl) related to wall geometry are automatically saved.

3. Save and exit **RecurDyn**.







Creating a Particleworks Model

Task Objectives

In this chapter, you can import wall files from Particleworks and create fluid particles by using inflow as a model for steam.



Starting Particleworks

Create a new model

- 1. Double-click the **Particleworks** icon on the Desktop.
 - 2. When you click **New Project** on the **File** tab, the **New Project** dialog box appears.

🚱 New Project		×
Steps	Choose Project	
1. Choose Project	Q Filter:	
	Categories:	Projects:
	Default	😫 Empty project
	Description:	
	Empty Particleworks project	
	L	
	< Back	Next > Finish Cancel Help

- 3. Click Next.
- 4. In the **Project Name** field, type **Styler_simulation**.
- 5. In the **Project Location** field, enter the location where the project will be created.
- 6. Click **Finish** to create the new model.

Copying a RecurDyn model and wall-related files

- In order for both software to perform co-simulation, the RecurDyn model and the Wall file must be in the Particleworks project folder.
- Move the Styler_flex_model_cloth_start.rdyn file, rd_pw.wall file, and WallGeometries folder you used in Chapter 3 to the scene folder in the folder where the Particleworks project was created. (Folder path: <Project Location>/Styler_simulation/scene)

Configuring a preprocess

Import a wall file

1. Double-click the **scene** folder in the **Projects** dialog box.



2. Click Start wizard.

The **PW Wizard** dialog box appears on the right.

Click the **Open** button to import the rd_pw.wall file.

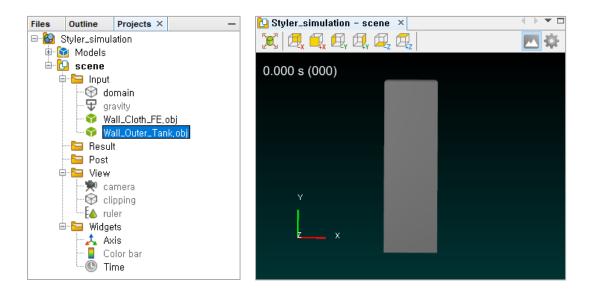
PW Wizard ×		-					
🔀 Styler_simulation 🔸 🎦 scene							
Objects	Model:	^					
⊡Model	Open						
⊐Inflow	Inflow:						
⊡Outflow	Rectangle						
⊐Fill	Circle						
Miscellaneous	Donut						

<Project Location>/Styler_simulation/scene/rd_pw.wall



4. Click the **Fit** button and the **+Z** plane button at the top of the **Working Window** to view the imported wall.

As shown on the left, you can check whether the **Wall_Cloth_FE.obj** and **Wall_Outer_Tank.obj** are properly **imported** into the **scene** tree and check the shape of the imported wall files as shown on the right.



Set Wall_Outer_Tank.obj transparency

You need to adjust the transparency because the inner **cloth** is not visible due to **Outer_Tank**.

1. In the Projects dialog box, double-click **Wall_Outer_Tank.obj** under **scene > Input**.

The **Object** dialog box associated with the **entity** you clicked is shown in the figure to the right.

2. Change the **Alpha** value in the **Appearance** panel to **0.2** and press **Enter**.

Wall_Outer_Tank.obj becomes transparent, allowing you to look its inside.

Key Frame	Obje	ct ×	Physic	s		-				
🜍 Wall_	😚 Wall_Outer_Tank,obj 🗌 Hid									
Parent	Parent 🖉 None 🗸 🗸									
Location	0	(m)	0	(m)	0	(m)				
Rotation	0	(°)	0	(°)	0	(°)				
Center	0	(m)	0	(m) 0		(m) 👪				
 ✓ Model Model 0: Wall_Outer_Tank, obj √ ✓ Appearance 										
Mode Solid ~										
Alpha		0,2								
Z Order		0								
Clip		\checkmark					¥			

Configure the camera

The default GUI setting of **Particleworks** is **Turn Table**, which is inconvenient to use. Switch the setting to a **Track ball** so that you can rotate it conveniently.

1. In the **Projects** dialog box, double-click **Camera** under **scene > View**.

The **Object** dialog box associated with the **entity** you clicked is shown in the figure to the right.

2. Change the Rotation Mode to Track Ball.

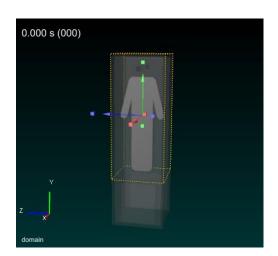
Key Frames	Object $ imes$	Physics	_				
় camera			🗹 Hide				
▼ Camera							
Parent	🖉 None	9	~				
Rotation Mode	Track Ba	all	~				
Eye Location	327356	(48266 (n	.02554 (
Target Location	n 012e-8	0,98 (m)	0 (m)				
Up Vector	0,051445	2 0,993689	0,09967				
Ortho							
Near	0,1 (m)					
Far	10000 (m	1)					

Set a domain

Domain is the area where fluid particles are analyzed. When the particles used as the steam fall down to the bottom, a reservoir at the bottom receives the water particles in the actual Styler. However, this analysis does not need to simulate the particles entering the reservoir. So, we will use a domain to delete the particles that fall down to the bottom.

- 1. In the **Projects** dialog box, double-click a **domain** under **scene > Input**.
- 2. Set the size of the **domain** as follows.
 - Upper limit: 0.3, 1.96, 0.3
 - Lower limit: -0.3, 0.55, -0.3

Key Frames	Object ×	Physics	-					
🛞 domain		🗌 Hide						
▼ Transform								
Parent	🖉 None		~					
Location	0 (m)	1,255 (m)	0 (m)					
Dimensions	0,6 (m)	1.41 (m)	0,6 (m)					
▼ Domain								
Upper limit (),3 (m)	1,96 (m)	0,3 (m)					
Lower limit	-0,3 (m)	0,55 (m)	-0,3 (m)					
Adjust domain								



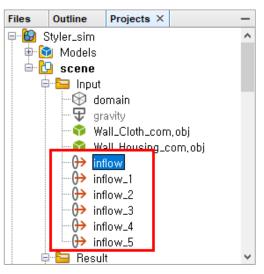
Create an inflow

Inflow is a function that lets particles flow to the user-defined zone at the user-defined speed or flux.

1. In the **PW Wizard** dialog box, click the **Circle** button six times.

In the **Projects** dialog box, six **inflows** are created in **scene > Input**.

PW Wizard ×		-						
🚱 Styler_simulation > 🎦 scene								
Objects	Model:	^						
⊡Model	Open							
🜍 Wall_Cloth_FE, obj	Inflow:							
🜍 Wall_Outer_Tank.obj	Rectangle							
⊡Inflow	Circle							
🕀 inflow	Donut							
↔ inflow_1	Open							
↔ inflow_2	Outflow: Rectangle							
🕀 inflow_3								
↔ inflow_4	Circle							
↔ inflow_5								
⊡Outflow	Open							
⊡Fill	Fill:							
Miscellaneous	Fill							



- 2. Double-click every **inflow** created in the Projects dialog box one by one to set the option values in the **Object** dialog box as shown below.
- Width and Height are set to the following values for all inflows.
 - Width: 0.1
 - Height: 0.1
- inflow
 - Location: 0.2, 1.73, 0.16
 - Rotation: 0, -90, 15
- Inflow_1
 - Location: 0.2, 1.73, -0.04
 - Rotation: 0, -90, 15
- Inflow_2
 - Location: 0.2, 1.73, -0.24
 - Rotation: 0, -90, 15
- Inflow_3
 - Location: -0.2, 1.73, 0.24
 - Rotation: 0, 90, -15
- Inflow_4
 - Location: -0.2, 1.73, 0.04
 - Rotation: 0, 90, -15
- Inflow_5
 - Location: -0.2, 1.73, -0.16
 - Rotation: 0, 90, -15
- 3. After confirming that the **inflows** are well defined as shown in the figure on the right, click the **Next** button in the **PW Wizard** dialog box to proceed to the next page.



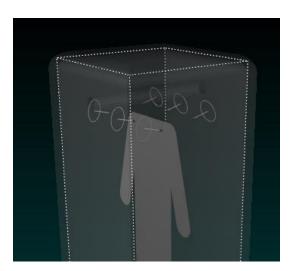
↔ inflow_2 (group: 4)									
▼ Transform									
Parent	0 N	🖉 None 🗸 🗸 🗸							
Location	0,2	(m)	1,73	(m)	-0,2	4 (m)			
Rotation	0	(°)	-90	(°)	15	(°)			
Center	0	(m)	0	(m) 0	()	n) 👪			
Туре	Circl	е				~	L		
Width	0,1	(m)							
Height	0, 1	(m)							

(+) inflow_4 (group: 6)									
▼ Transform									
Parent	0	🖉 None 🗸 🗸							
Location	-0,2	(m)	1,73) (m)	0,04	(m)			
Rotation	0	(°)	90	(°)	-15	(°)			
Center	0	(m)	0	(m) 0	(п	n) 👪			
Туре	Circl	e				\sim			
Width	0,1	(m)							
Height	0, 1	(m)							
	 Transf Parent Location Rotation Center Type Width 	 Transform Parent N Location -0.2 Rotation Center Circl Width 0.1 	 Transform Parent ⊘ None Location -0,2 (m) Rotation 0 (°) Center 0 (m) Type Circle Width 0,1 (m) 	Parent ⊘ None Location -0.2 (m) 1.73 Rotation 0 (°) 90 Center 0 (m) 0 Type Circle Width Width 0.1 (m) 0	▼ Transform Parent	▼ Transform Parent	▼ Transform Parent ⊘ None ∨ Location -0,2 (m) 1,73 (m) 0.04 (m) Rotation 0 (*) 90 (*) -15 (*) Center 0 (m) 0 (m) 0 (m) Image: Second Se		

(→ inflow_1 (group: 3)					de		
🔻 Transf	orm						^
Parent	0	lone				\sim	
Location	0,2	(m)	1,73	(m)	-0,0	4 (m)	
Rotation	0	(°)	-90	(°)	15	(°)	
Center	0	(m) ()	(m) 0	(m) 🔛	
Туре	Circl	е				~	
Width	0,1	(m)					
Height	0, 1	(m)					

↔ inflow_3 (group: 5)						de	
🔻 Transf	orm						^
Parent	0 N	one				\sim	
Location	-0,2	(m)	1,73	8 (m)	0,24	(m)	
Rotation	0	(°)	90	(°)	-15	(°)	
Center	0	(m)	0	(m) 0	(r	n) 🚦	
Туре	Circl	е				\sim	
Width	0, 1	(m)					
Height	0, 1	(m)					

	↔ inflow_5 (group: 7)					de		
Location -0.2 (m) 1.73 (m) -0.16 (m) Rotation 0 (°) 90 (°) -15 (°) Center 0 (m) 0 (m) 0 (m) Type Circle Width 0.1 (m)	🔻 Transf	▼ Transform						^
Rotation 0 (°) 90 (°) -15 (°) Center 0 (m) 0 (m) 0 (m) Image: Center Image:	Parent	0 N	lone				\sim	
Center 0 (m) 0 (m) 12 Type Circle <t< th=""><th>Location</th><th>-0,2</th><th>(m)</th><th>1,73</th><th>(m)</th><th>-0, 1</th><th>6(m)</th><th></th></t<>	Location	-0,2	(m)	1,73	(m)	-0, 1	6(m)	
Type Circle V Width 0.1 (m)	Rotation	0	(°)	90	(°)	-15	(°)	
Width 0.1 (m)	Center	0	(m)	0	(m) 0	(1	n) 👪	
	Туре	Circl	e				\sim	
Height 0.1 (m)	Width	0, 1	(m)					
noight (iii)	Height	0, 1	(m)					



Create and configure physical properties

1. At the bottom of the **PW Wizard** dialog box, click **Manage physical properties...**.

PW Wizard ×	-
🚱 Styler_simulation >	🖸 scene
Objects	Physical property
∃Model	
😚 Wall_Cloth_FE, obj	None
😚 Wall_Outer_Tank,o	None
∃Inflow	
🕀 inflow	None
(→ inflow_1	None
↔ inflow_2	None
(→) inflow_3	None
(→ inflow_4	None
(→ inflow_5	None
∃Outflow	
∋Fill	
Manage phy:	sical properties,
< Back Next >	Execute Close

2. When the **Physical property manager** dialog box appears, click the + button to create a **fluid**.

The basic physical property of the generated fluid is water. So you can use it as is.

3. Click the + button again to create a **polygon**.

Polygon is a physical property that specifies the rigid or flexible body defined as a wall by RecurDyn.

🚱 Physical property manager		×
General Interactions		
Image: Second	Name Thermal Boundary Thermal Conductivity Young's Modulus Poisson Ratio Hamaker Constant	1 (GPa) 0 10 (10 ⁻²⁰ J)
+ 0 -	Surface Roughness	0 (m)

4. Click the **Save** button to close the dialog box.

- 5. In the **PW Wizard** dialog box, change the **physical properties** from **None** to the values specified below.
 - Wall_Cloth_FE.obj: Polygon
 - Wall_Outer_Tank.obj: Polygon
 - All inflows: Fluid

- 6. In the **Physics** tab of every **inflow**, set the value for **Emit Velocity** as shown below.
 - Emit Velocity: 1
- 7. In the **Physics** tab of **Wall_Cloth_FE.obj**, check **Double-sided DF** and set the Thickness of Polygon as follows.
 - Thickness of Polygon:1

PW Wizard ×			-			
🔀 Styler_simulation > 🎦 scene						
Objects		Physical property				
⊡Model			-			
💙 Wall_C	loth_FE, obj	🗿 Polygon				
💙 Wall_O	uter_Tank, o	🖓 Polygon				
⊡Inflow						
(→ inflow		虢 Fluid				
(→ inflow_1		虢 Fluid				
↔ inflow_2		虢 Fluid				
↔ inflow_3		虢 Fluid				
↔ inflow_4		虢 Fluid				
(→ inflow_5		虢 Fluid				
⊡Outflow						
⊐Fill			~			
Manage physical properties						
< Back	Next >	Execute	Close			

Key Frames	Object	Physics ×		-	
()→ inflow				Hide	
🔻 Physical Pr	operty			^	
Type 👯 F	luid		×		
Physical Property Values					
▼ Details					
Emit Mode	Velo	city		~	
Emit Velocity	1	(m/s)			
Unner Limit	1000	/3\		~	

Key Frames	Object	Physics \times	_		
😚 Wall_Cloth_FE,obj (group: 1) 🗌 Hide					
🔻 Physical Pr	operty				
Type 🗳 Po	lygon	~			
Physical P	'roperty Va	lues			
🔻 Details					
🖲 🔿 Flo	w Resi	0 00			
		0	uuiuw		
Initial Tempera	ature 0	(°C)	uuiuw		
Initial Tempera Particle Margi		(°C)			
	n 0,	(°c) 9			
Particle Margi	n 0. DF 🗹	(°c) 9			
Particle Margin Double-sided	n 0. DF 🗹	(°c) 9			

8. Click the **Next** button at the bottom of the **PW Wizard** dialog box to proceed to the next page.

Configure particles and preferences

In the PW Wizard dialog box, change the preferences.

- 1. In the **Particle Size** field, enter **0.01**.
- 2. Click **Next** to proceed to the next page.

➡ Preprocess Settings					
Coordinate System	xyz		~		
Particle Size	0,01	(m)			
Auto Grid Interval	\checkmark				
Flow Resistance Res,	0,5				

Note: In the case of **SPI**, the **unit** in **Particleworks** must be set to **meter** regardless of the **unit** in **RecurDyn**. If the unit in **RecurDyn** is set to **meter**, you don't need to convert the **particle size** or **domain size** and you just need to use the same values in Particleworks. If the unit in **RecurDyn** is set to **millimeter**, you need to convert the millimeter values to the meter values and enter the meter values in **Particleworks**.

- 3. In the Y field of the **Gravity** pane, enter **-9.8**, just like in **RecurDyn**.
- 4. Set the **Viscosity** option as shown below.
 - Type: Implicit
- 5. Leave the others at the **default** settings and click **Next**.
- 6. On the **Thermal** page, press **Next** without changing any of the default values.

👸 Styler_simulation > 🎦 scene	
▼ Gravity	
Gravity 0 _(m/s²) -9,8 _(m/s²) 0	(m/s ²)
▼ Pressure	
Type Implicit	~
Mode Stabilized	~
✓ Viscosity	
Type Implicit	~
Beta 1	
▼ Surface Tension	
Type None	~
▼ Turbulence	
Type None	~

Configure analysis conditions

Set the analysis options in the PW Wizard dialog box.

- 1. In the **Time** pane, enter **0.0005** in the **Initial dt[s]** field.
- 2. Enter 0.01 in the File Output Interval Time[s] field.

🚱 Styler_sim_mm 🔸 🎦 scene					
▼ Time			^		
Finish Time	10 (s)				
Initial dt	0,0005 (s)				
▼ Output Set	ttings				
Format		v6 ~			
Precision		d ~			
Туре		si 🗸			
File Output Ir	nterval Time	0,01 (s			
File Output S	}kip				
Load / Torq	ие Туре	S ~			

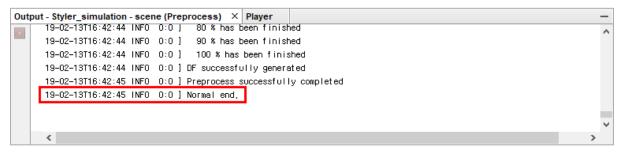
Create particles

1. In the **PW Wizard** dialog box, click the **Execute** button when you have finished all the settings.

The **Run** dialog box appears.

- 2. Set the **Run** option to **Preprocess**.
- 3. Click Execute.

If the message saying that the particle creation is completed appears in the **Output** dialog box as shown below, the particles have been created.



Preparing for Co-simulation

To do co-simulation in RecurDyn, you need to create some files in Particleworks. The relevant files are automatically generated by Particleworks as you go through the standalone analysis.

Perform standalone analysis in Particleworks.

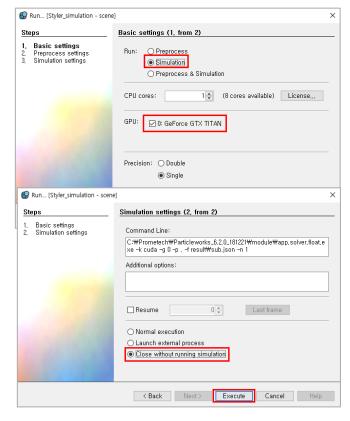


1.

- On the Simulation tab, click Run. 2. Set the **Run** option to **Simulation**.
- Enter the number of **CPU cores** to 3. be used for the analysis.

If there is a GPU, select the GPU to be used for the analysis.

- 4. Click Next.
- 5. Check Close without running simulation.
- 6. Click Execute.



7. Save the project.

The Particleworks program may be turned off in Chapter 5. However, in this tutorial, we will proceed to the next chapter with the program turned on to check the analysis results in real time during analysis.



Co-simulation

Task Objectives

In this chapter, we will perform co-simulation using RecurDyn and Particleworks to analyze the interaction between flexible bodies and particles.



Co-simulation

Perform co-simulation in RecurDyn

- Run RecurDyn and open the Styler_flex_model_cloth_start.rdyn file you copied in Chapter 4. (File path: <Project Location>/ Styler_simulation/scene/Styler_flex_model_cloth_start.rdyn)
- 2. In the **Simulation Type** group of the **Analysis** tab, click **Dyn/Kin** to open the **Dynamic/Kinematic Analysis** dialog box.
- 3. Check the simulation end time and step.
 - End Time: 1
 - Step: 500

Dyn/Kin

Dynamic/Kinematic Analysis	×					
General Parameter Initial Condition						
End Time 1	Pv					
Step 500.	Pv					
Plot Multiplier Step Factor 1.	Pv					
Output File Name						
└────────────────────────────────────						
Static Analysis						
Eigenvalue Analysis						
State Matrix						
Frequency Response Analysis						
Hide RecurDyn during Simulation						
Display Animation						
Gravity						
х 0. ү -9806.65 Z 0. Gravity						
Unit Newton - Kilogram - Millimeter - Second						
Export RSS Simulate OK	Cancel					

4. Click **Simulate** to perform the analysis.

Tip: Some of the options in the Dynamic/Kinematic Analysis dialog box are as follows.

- End Time: Defines the simulation duration.
- **Step**: Defines the number of frames that are saved during the entire simulation duration.
- **Plot Multiplier Step Factor**: Defines the number of saved data points for plotting. The number of plot data points is defined by multiplying Step by Plot Multiplier Step Factor.

Chapter 6

Checking the Analysis Results

Task Objectives

In this chapter, we will check how particles affect a flexible body using Contour.



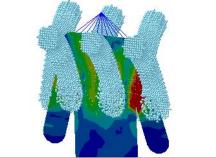
Checking Contour

After the analysis is completed, you can check the result using Contour to see whether the particles affect the flexible body. And since we do not actually model the exact physical properties and interactions of the fabric, the values from the stress or reaction force are not exact experimental values. So please check only whether the flexible body is affected by the particles.

- 1. In the **FFlex** group of the **Flex** tab, click **Contour**.
- 2. In the **Contour** dialog box, set the **Type** to **User Defined** and click the **Calculation** button.

≷ Contour							×
Contour Option		Band Option			1	lode / Reference Marker	
Animation Status	SMISES	Legend Type	Display 🔻	Sel	Body		Ori.
Туре	Stress 💌	Location	Bottom 👻	•	Cloth_FE	50434	
Component	SMISES 🔻		Show Text Legend				
Display Vector	175.954155715775	Band Level(10~50)	10				
Uniform	Simple	Style Option					
Contact Surface C	Only	Color Option	Edit	Cont	our Data Trac	e	
User define	d contact surface	Colors		Sel	Body	Node ID	
Contact pat	tches only	Colors	Spectrum 🔻			///	
		Style	Stepped 💌				
Min/Max Option —]	Text Color	Text Color 🔹				
Type User Defined		Exceed Max Color	Max Color 👻				
	alculation	Less than Min Color	Min Color 🔹		Add	Delete	
Calculation				Cont	our Element S	et Selection	
Min	0 0			Sel	Body	Contour Part	
Max	0 2						
Show Min/Max	Enable Log Scale						
User Defined Max	Color						
User Defined Min	I Color	Mesh Lines	Line Color 🔹		Add	Delete	
Enable Contour V	/iew						
Export			ОК		Cance	Apply	

- 3. Change the Max value of User Defined to 2 and click OK.
- 4. In the **Animation Control** group of the **Analysis** tab, click the Play button to see **Contour**.



Thanks for participating in this tutorial