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MECHANISM DESIGN ESSENTIALS IN **3DEXPERIENCE 2016x** USING CATIA APPLICATIONS





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Chapter 02

Block Accelerating along a Path

Introduction

In this tutorial you will create a block which accelerates along a straight line according to a user prescribed formula. A prismatic joint is used to simulate this simple mechanism.

NOTE: It is assumed that you have basic familiarity with CAD modeling in 3DEXPERIENCE allowing you to create an assembly consisting of two blocks. If that is not the case, please consult the following tutorial book:

CAD Modeling Essentials in 3DEXPERIENCE, by Nader Zamani, SDC Publications, ISBN 978-1-63057-095-8.

Problem Statement

The block shown below is starting from rest and moving along the base with a constant acceleration of 2 in/s². A simple integration of the acceleration term results in the expressions for position and velocity along the base. These expressions are given by $s(t) = t^2$ and v(t) = 2t respectively.

The travel time from one end of the base to the other end is $t = \sqrt{20} \approx 4.47$ s. In this tutorial, you will create the assembly and the needed joint. The problem under consideration involves a Prismatic Joint with the block sliding along the edge maintaining the surface contact.



The graphical representation of the position and velocity vs time are provided below, where t is in seconds, s(t) is in inches, and v(t) is in inches per second.



Creation of the Assembly Constraints in the Assembly Design App.

Using the Assembly Design App. distribution in 3DEXPERIENCE, model two parts named Block and Track as shown below with the dimensions being in inches.





Assembly

While in this App, you will be creating the appropriate constraints. The first assembly constraint is to "Fix" the Track.

From the bottom row, select the "Assembly" tab.



Product Edition

Next, select the "Engineering Connection" to see the choices.

Finally, choose the "Fix" icon

Use the cursor to pick the Track part from the screen or the tree. Immediately, the tree acquires a new branch named "Engineering Connection" as shown below which upon expanding reveals that the Track has been fixed. Note that this information is also inherited by the Track A.1 (Track) as a part within the assembly.



The marking indicates that the constraint needs to be updated. This can be achieved with

the update icon

1-A Connections of Track 1-12 Fix.1 The marking indicates that the constraint needs to be H **Engineering Connections** updated. This can be achieved with the update icon 0 Fix.1 (Track) 由心

The next step is to create the constraints between the Track and the Block which eventually leads to a "Prismatic" joint.

Click on the Engineering Connection

icon

The dialogue box shown on the right opens up.

gineerin	g Connec	tion Def	inition					8	23
🕲 Co	onstraints	8	Interference	s 💊	Contact]			
Type:	🎕 Use	er Define	d 🖣	£	Auto	matically	position	n comp	or 🔻
Туре	Mode	Pref	Support		Lower	Value	Upper		
city			Select an e	element					
						_		-	
							ОК	Ca	ncel

Using the pulldown menu, display the list of the joints that can be created.



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Туре: 🛕 🐧	🕅 Prism	natic	-		Auto	matically	position	comp	or 🔻
Type M	lode F	Pref	Support		Lower	Value	Upper		
45) 			Select an e	lement					
						_		_	
							OK	Ca	ncel

Select the "Prismatic" joint as shown.





As soon as this is done, the two parts move and the two edges become coincident.



The task, however, is not complete yet. We must establish a constraint between the faces. These two faces must remain in contact. While the dialogue box is open, select the top face of the Track and the bottom face of the block as shown. The dialogue box records these actions.



As soon as the selection is made the following window opens. Select "Yes." The tree clearly shows the presence of a prismatic joint.

Undefined I	Interference Specifications
?	Current interference status is "contact". Do you want to make "check contact" a specification?
	Yes No Cancel

The marking indicates that the constraint needs to be updated. This can be achieved with the update icon



The Block may be positioned in the middle of the track. For convenience, it is better if the Block is at the end of the track. One way to achieve this is to create a constraint between the corners of the block and track. This constraint, however, will be deleted; otherwise, it becomes a "Spherical" joint preventing movement of the Block.

Click on the Engineering Connection icon



The dialogue box shown on the right opens up.







From the screen, select the vertex of the Block as shown.





Next select the vertex of the Track below.



As soon as the vertex is selected, the above dialogue box opens. From this box, select "New connection" and press "OK."

Undefined Interference Specifications

Current interference status is "contact".

Once again you are prompted for the following window. As in the earlier case, select "Yes."

The presence of the "Spherical" joint is confirmed in the tree. As indicated earlier, this "Spherical" joint must be deleted. The sole purpose of the constraint was to position the Block at the end of the Track.

Point the cursor to the branch with "Spherical" joint, right click and "Delete."





Spherical.3 (Block <->Track)

Do you want to make "check contact" a specification?



Finally, update the constraint by using the update icon

It is worth mentioning that the constraints applied so far (or the joints created so far) appear not only in the assembly but are also reflected in the individual parts. See the tree shown below.



Creating the Mechanism in the Mechanical System Design App.

Locate the compass on the top left corner of the screen, and select the South sector (i.e., V+R sector) as shown on the right. Scroll through the applications and select the Mechanical System





Press F1 for more help.

æ)

The row of icon in the bottom of your screen changes and will appear as displayed below.



This selection leads to the following dialogue box. Needless to say, customized names can be used. Click on "OK." The tree reflects the selection.

~	Mechanism Representation
Accelerating Block A.1	A Mechanism Representation
Nader Mechanism Representation00000716	Title Nader_Mechanism Representation00000716
Joints	Name mec-R1132100373266-00000716
Commands	Description
Block A.1 (Block)	Design Range Normal Range 💌
Track A.1 (Track)	Collaborative Policy Global Design Definition
Engineering Connections	OK Cancel

The tree indicates that two joints have been created but there are presently no commands present.

Accelerating Block A.1
Nader Mechanism Representation00000716 A.1
Joints
₩-₩ Fix.1
🖶 🖚 Prismatic.2
Commands

Select the "Mechanism Manager" from the bottom

of your screen by left clicking on **f**.

	Mechanism Manager
	Mechanism Manager
	Allows setting up mechanism properties.
Product Edition	Press F1 for more help.
D fa	· · · · · ·

The "Mechanism Manager" dialogue box opens up as shown below.

echanism M	anager				β Σ
- Status	DOF with co DOF withou on status : O	ommands: t command Automatic	1 1 Is: 1 0 () Manual	Number of con Command dep Jpdate status	nmands: 0 endency: No
Joints	Assembly				
Filter:	•			O Only includ	ded 🖲 All
Included	Name	Туре	Command 1	Command 2	Context
a	Fix.1 Prismatic.2	Fix Prismatic	- Not Drivable	-	Accelerating Block A.1 Accelerating Block A.1
Joints Ma	nagement — de de		de All de All	mand Manage by: [ment Length 1 Length 2 Angle 1 Angle 2
					OK Cancel

The icon on the top left corner is an indication that there is no command associated with the mechanism and, therefore, it cannot be simulated yet.

To address this issue, double click on the "Prismatic" joint in the tree. This can be done from any location where the joint is displayed. The most natural choice is from the joint branch on the top of the tree.

Accelerating Block A.1	
Nader Mechanism Representation00000716 A.1 Joints Double click to open the window	Engineering Connection Definition
Commands Block A.1 (Block) Track A.1 (Track)	Type Mode Pref Support Lower Value Upper Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support Image: Support
Engineering Connections FX1 (Track) Prismatic.2 (Track <->Block)	Select an element

Place the cursor on the highlighted blue area, right click and select "Insert."



From the supplied list, select "Offset" as shown.

ngineerin	ig Conne	ction Def	finition						? X
@ c	onstraint	s 🔇	Interferen	ces	i n n n n n n n n n n n n n n n n n n n	ontact]		
Туре:	🔞 Pi	ismatic		•	A 🎢	Auto	matically	position	compor 🔻
Туре	Mode	Pref	Support			Lower	Value	Upper	
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			🎾 Face						
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	0	Coincide	ence						
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		Fix		•				OK	Cancel
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		A <u>d</u> vance	ed	۰I					

For the offset, select a vertex of the Block followed by the back face of the Track. These are displayed in the following figures.



Note that as soon as the selection is completed, a warning sign (exclamation mark) appears in front of "Type Prismatic."



It is important to address this issue now. Point the cursor to the line where the "Offset" is and the location shown (the Mode column) on that line. Right click and select "Controlled." This instruction is very critical and the reader may have to try it a few times before getting it to work; see detailed figures on the next page.

Type: /	N 🕅 Pri	smatic	Thereferences	Autor	I natically positio	on compor
Туре	Mode	Pref	Support	Lower	Value Upper	r i
0	۹ <u>۴</u>	1 27	2 Edge			
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1-1	¢ <u>د</u>	۲	Face Face		0in	_
	1		Vertex			
Ś			Select an elen	nent		
					ОК	Cance

Point the cursor to this location and right click.

60 Ci	onstraints		Inte	rferenc	es	≪2C 1 ∞	ontact				_	
Type: 🥂	🖌 👊 Pri	smatic			- 🗰		Auto	matically	position	compo	r 🔻	
Type	Mode	Pref	Su	pport			Lower	Value	Upper		^	
\$*	ŝ.	щ _л	\$ \$	Edge Face Face							E	
M		iving		Ĺ.				0in				
an.	18. M	easured		Ĩ	eleme	nt					- I I	

Right Click and select "Controlled"

Upon completing this task, the "Warning" (exclamation sign \triangle) is gone as shown below.



Finally, update the constraint by selecting the update icon

Once again, select the "Mechanism Manager" from the bottom of your screen by left clicking on f

The "Mechanism Manager" dialogue box opens up as shown below.

Command 1 Command 2 Context Type Fix.1 Fix Accelerating Block A.1 Prismatic.2 Prismatic Not Drivable Accelerating Block A.1 Command Management Driven by: 👍 Include All 🗌 Length 1 🔲 Length 2 🗌 Angle 1 📄 Angle 2 Exclude All OK Cancel

is still in the top left corner as an indication that there is no command The icon associated with the mechanism and therefore it cannot be simulated yet. So on the surface, it seems that the last three pages have not changed the picture. However, that is not the case as will be discussed next.







In the "Mechanism Manager" window, select the "Prismatic" joint which will be highlighted. In the bottom right corner, there is a section titled "Command Management." Notice that by defining the "offset" earlier, now one can select "Length 1" as a desire command. Therefore, check this box.



Select "OK" which then closes the window.

- Command Ma

Driven by:

agement

🗹 Length 1 🗌 Length

Angle 1 Angle 2

Joints Management

&

Exclude

&

Exclude All

Once again, select the "Mechanism Manager" from the bottom of your screen by left clicking on *f*.

Now the situation is different. The status on the top left corner of the window has changed to green and the mechanism can be simulated.

	Status DOF with 0 DOF with 0 DOF with 0	commands: ut command	ds: 1	Number of con Command dep	mands: 1 endency: No		
Status has changed to green	Joints Assembly						
-	Included Name	Туре	Command 1	Command 2	Context		
	Fix.1	Fix	-	-	Accelerating Block A.1		
	Prismatic2	Prismatic	Length	- mand Manage	Accelerating Block A.1		
		4 Inch	ide All Driven	by:	Length 1 🗌 Length 2		
	Exclude	Exclu	ıde All	0	Angle 1 🗌 Angle 2		
					OK Cancel		
-							

One should also pay attention to the DOF count and compare it before the selection of "Length 1" as a command. See the comparison on the right.

63	DOF with commands:	0	Number of commands:	1
	DOF without commands:	1	Command dependency:	No
omputati	on status : O Automatic ®	Manual	[Indite status]	
Status				
Status	DOF with commands:	1	Number of commands:	0
Status	DOF with commands: DOF without commands:	1	Number of commands: Command dependency:	0 No

The Tree clearly indicates that a "Command" has been created.



Double clicking on the "Command" in the tree opens the "Mechanism Player" dialogue box shown on the right. This problem has one degree of freedom and therefore there is a single "Sliding Bar." By dragging the sliding bar to the left or to the

right, the Block begins to move along the Track. The number 3.937 means it can make a

move to the left and to the right by 3.937 in. The range of movement can be changed as explained next.

The "Reset All" button positions the Block in the original location which is the zero distance.

Double click on the "Prismatic" branch in the tree to open the corresponding dialogue box. Select the line dealing with the "Offset" constraint as shown on the right.

Place the cursor in the location shown, in the column below the "Lower" label, and left click to open a new dialogue box. Initially, the value is "Unset."

The "Unset" value in the box should be changed to -20 (negative 20).

Next you will set the "Upper" value of the movement of the Block.



ОК

Lower Value Uppe

Select the "Offset" line





👻 🔒 🧪 Automatically p

neering Connection Definition

0 Prismatic

Pref...

Type:

🐼 Constraints 🖓 Interferences 🗳 Contact

Support Cloge Cloge Sace Sace

Vertex



i.e., in the column below the "Lower" label, and left click to open a new

2

Place the cursor in the location shown in the column below the "Upper" label and left click to open a new dialogue box. Initially the value is "Unset."

The "Unset" value in the box should be changed to 20 (positive 20).

The range of movement of the Block is between - 20 and +20 in. The zero position corresponds to

the Block being at the end of the Track.



Place the cursor in this location, i.e., in the column below the "Upper" label, and left click to open a new dialogue box

🕸 C	onstraint	s 🔇	Interferences	ା 🗞 (ontact	1			
Type:	🛍 Pr	ismatic	-	A /	Auto	matically	position	compo	or 🔻
Туре	Mode	Pref	Support		Lower	Value	Upper		*
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			Edge						Ξ
dir.	941	RC 21	¶≢ Face						
141	ile:	-	Face	-	=20in	0in	20in		
			• Vertex						
\$			Select an e	lement	-T_		- Î		Ŧ
						_		-	
							ОК	Car	ncel

The range of movement of the Block is between -20 and +20 in. The zero position corresponds to the Block being at the end of the Track.

2 23

Double clicking on the "Command" from the tree opens the "Mechanism Player" window and by dragging the sliding bar, the Block moves in the range of -20 to 20 in. as shown below.

chanism Player

Before you introduce some physics into the problem (specifying the constant acceleration), it is a good idea to delete any limits which were imposed on the "Lower," "Value," and "Upper" columns.

This can easily be achieved by opening the "Prismatic" joint window, selecting the "Offset" row, placing the cursor in the proper column. You then right click and pick "Unset."



This has to be done until no values appear for "Lower," "Upper," "Value."

Finally update the constraint if necessary by selecting the update icon



Creating the Physics and Simulating the Desired Kinematics

Locate the compass on the top left corner of the screen, and select the South sector (i.e.,V+R sector) as shown on the right. Scroll through the applications and select the Mechanical System



Experience App Experience



The row of icons on the bottom of your screen changes and will appear as displayed below.



The top of your screen indicates that you are now in the "Mechanical System Experience" App.

Ĩ	3DEXPERIENCE CATIA Mechanical System	ems Experience My C	ontent
	Accelerating Block A.1 Nader_Kinematics Simulat	×	
	Nader_Kinematics Simulation000002591		
	Ader_Mechanism Representation000000	l Mechanical System Experience Ap	р
	Fix.1	> New branches	
	Commands Command.2 (Prismatic.2)		
	Block A.1 (Block)		
<<	Track A.1 (Track) Engineering Connections		
	Scenario.1 - Kinematics Scenario		

This application is where the physics of the problems can be specified, and kinematics results including graphs of displacement, velocity and acceleration can be generated.

As soon as you land in this application, the following two dialogue boxes appear where you can select defaults, or customize the names as you see fit.

Mechanical Systems Expe ? X				
Simulation Object Creation				
Product:				
Accelerating Block A.1				
□ Create a mechanism 🗊 ☑ Create a kinematics scenario 🕍				
OK Cancel				

Ki	nematics Simulation	ß	x
	Kinematics Sir	nulation	
	Title	Nader_Kinematics Simulation000002591	
	Name	sim-R1132100373266-000002591	☆
	Description		
	Collaborative Policy	Global Design Evaluation	
		ОК Са	incel

The third window popping up is shown on the right. This defines the "Scenario" created for the mechanism. The window shown has three tabs. Click on the "Parameters" tab.

The parameters specified are the "Start time," "End time," and the "Time step." For the present problem, change the "End time" to 1s and the "Time step" to 0.1s.

The "Probe" tab, if selected, does not contain any information as nothing has been defined yet.

Kinematics Scenario	8 22				
Name: Scenario.1 Mechanism: er_Mechanism Representation000	00716 A.1				
Excitations Probes Parameters					
Select excitations used for the scenario:					
Available Referenced	.				
OK Cancel	Preview				

Kinematics Sco	enario	8	23
Name: Mechanism:	Scenario.1 er_Mechanism Representation00000	716 A	.1 🖁
Excitation	s Probes Parameters		
Start time:	Os		
End time:	10s		
Time step:	1s		
	OK Cancel	Pre	view

Kinematics Sco	enario		? x		
Name: Mechanism:	Scenario.1 er_Mechanism R	lepresentati	on00000716 A.1 🖁		
Excitation	s Probes P	arameters			
Start time:	0s				
End time:	10s 🔶				
Time step:	0.1s 🗲	Cł	nange		
		fro	om 10s 1s —		
Change from 1s to 0.1s					
	OK Cancel Preview				

Select the "Position, Speed and Acceleration Probe"



from the bottom row of icons.

The plan is to plot the position, velocity, and the acceleration of the top vertex of the Block as a function of time.

The following pop up window allows you to pick the appropriate point.



For the "Supports," select the indicated vertex of the Block. See the figure below.



Double clicking on the "Scenario" branch opens the "Kinematic Scenario" dialogue box as shown on the right. Now, if the "Probes" tab is selected, the field is no longer empty and it contains the information on the vertex (point) selected.



From the bottom row of icons (the action bar), select the

"Law Excitation" icon

The following dialogue box opens up.

Law Excitation 😐 🗉 🔀				
Name: Law Excitation.1				
Supports: No selection				
OK Cancel				

For the "Supports" select the "Command.2 (Prismatic.2)" from the tree.

Next, from the same dialogue box, while it is open, select "f(x)."



Nader_Kinematics Simulation000002591 A.1

- 🕼 Nader_Mechanism Representation00000716 A.1

Accelerating Block A.1

Joints

Fix.1

🛷 Commands

Model

The window shown on the right pops up. This is a very important dialogue box named "Formula Editor" and it enables you to write equations defining the physics of the problem.

Formula Editor: `Excitations\Law	/ Excitation.1\Length`	8 2		
Excitations\Law Excitation.1\l	Length	<u> R</u> @25C		
0mm				
Dictionary	Members of Parameters	Members of All		
Parameters Advanced Mathematics F Constant Design Table Law List Math Messages and macros	All Renamed parameters Length Time Boolean Feature Set Of Relations Formula	Excitations\Law Excitation.1\Length' 'Excitations\Law Excitation.1\Time' 'Scenario.1\Scenario Parameters.1\Scenari 'Scenario.1\Scenario Parameters.1\Scenari 'Scenario.1\Scenario Parameters.1\Scenari 'Relations\Formula.1\Activity Excitations\Law Excitation.1' 'Excitations\Law Excitation.1'		
OK Cancel				



Law Excitation 🔲 🗉 🖾

OK Cancel

Name: Law Excitation.1

Supports: No selection

In the first section of this chapter it was assumed that the Block has a constant acceleration and, therefore, the position of the Block as a function of time is given by

$$s(t) = t^2 = 1in (t/1s)^2$$

Note that the equation above must be dimensionally correct; i.e., the appropriate information must be included. The unit of s(t) is inches; therefore, the time is nondimensional (dividing by 1s), and the prefix 1*in* is introduced.

One has to follow a sequence of actions in this dialogue box to input the proper formula.



Formula Editor: `Excitations\Law Excitation.1\Length

Members of Pa

All Renamed pa

Length Time Boolean Feature Set Of Relations

Formula

Excitations\Law Excitation.1\Length

Advanced Mathematics F Constant Design Table

Messages and macros

Excitations\Law Excitation.1\Time

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Paramete

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•



"Excitations\Law Excitation.1\Time"

After changing the entry to "1in" you need to type the equation first by typing "*" which is the multiplication operator. Then, within parentheses, the word 'Excitations\Law Excitation.1\Time'. An alternative way is to double click on the name from the "THIRD" column. This automatically places it in the desired location.



Members of Tim

`Excitations\Law Excitation.1\Time

Scenario.1\Scenario Parameters.1\Scenario.1 Scenario.1\Scenario Parameters.1\Scenario.1

Select "Time" from the list

2 XX

÷

80850



1in*(`Excitations\Law Excitation.1\Time`/1s)**2

Next, complete the equation as shown below.

Formula Editor: `Excitations\	Law Excitation.1\Length`	8 23			
1		<u> </u>			
Excitations\Law Excitation.1\Length =					
1in*(`Excitations\Law Excitations	ation.1\Time`/1s)**2				
Dictionary	Members of Parameters	Members of All			
Parameters Advanced Mathematics F Constant Design Table Law List Math Messages and macros	All All Ength Time Boolean Feature Set Of Relations Formula	Excitations\Law Excitation.1\Length` 'Excitations\Law Excitation.1\Time` 'Scenario.1\Scenario Parameters.1\Scenari 'Scenario.1\Scenario Parameters.1\Scenari Relations\Formula.1\Activity Relations\Formula.2\Activity Excitations			
OK Cancel					

The "Law Excitation.1" now appears in the tree.



Finally, update the tree by selecting the update icon



Press "OK" and close the window that pops up. This is the "Simulate and Generate Results" window.



Taking a close look at the screen, you will see that the Block starts moving on the Track; however, it may be moving in the wrong direction as shown on the right. This can easily be fixed.



The steps to fix the direction are explained on the next page.



In the resulting dialogue box, multiply the right-hand side of the equation describing the length by a factor of "-1."

١	Formula Editor: `Excitations\Law Excitation.1\Length`	8 23
	醫	8025C
	Excitations\Law Excitation 1\Length	
	1in*('Excitations\Law Excitation.1\Time'/1s)**2	
	Dictionary Members of Parameters	Members of All
	Parameters All Advanced Mathematics F Length Design Table Length Law Boolean List Set Of Relations Messages and macros Formula	Excitations\Law Excitation.1\Length Excitations\Law Excitation.1\Time Scenario.1\Scenario Parameters.1\Scenari Scenario.1\Scenario Parameters.1\Scenari Relations\Formula.1\Activity Relations\Formula.2\Activity Excitations
		OK Cancel
Multiply by a factor of (-1)		
ſ	Formula Editor: `Excitations\Law Excitation.1\Length`	8 2
	B	<u>R</u> 9296
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		OK Cancel

Repeat the steps already described on top of page 2-25. From the bottom row of icons (action bar), click on the "Simulate and Generate Results"



The block now moves in the other direction as desired.

Also note that the results for "Scenario.1" have been generated as indicated in the bottom of the tree.





The final step is to create several plots which will confirm the physics imposed. If you are not already in the "Results" tab, double click on the "Results of Scenario.1" branch in the tree to land you there. The bottom row of icons will look as shown below.



This window has two more tabs where certain default plots have been generated and data stored. The contents of the two tabs when selected are displayed in the following two figures.



Result of	esult of Scenario.1										
Time (s)	Length [X_Vertex [Y_Vertex [Z_Vertex [X_LinearVelocity [P	Y_LinearVelocity [P	Z_LinearVelocity [P	LinearVelocity(Magnitude)	X_LinearAcceleration [Y_LinearAcceleration [Z_Linez
)	0	1	0	1	0	0	0	0	0.2	0	0
0.1	-0.001	1.001	0	1	0.02	0	0	0.02	0.2	0	0
0.2	-0.004	1.004	0	1	0.04	0	0	0.04	0.2	0	0
0.3	-0.009	1.009	0	1	0.06	0	0	0.06	0.2	0	0
0.4	-0.016	1.016	0	1	0.08	0	0	0.08	0.2	0	0
).5	-0.025	1.025	0	1	0.1	0	0	0.1	0.2	0	0
0.6	-0.036	1.036	0	1	0.12	0	0	0.12	0.2	0	0
).7	-0.049	1.049	0	1	0.14	0	0	0.14	0.2	0	0
.8	-0.064	1.064	0	1	0.16	0	0	0.16	0.2	0	0
.9	-0.081	1.081	0	1	0.18	0	0	0.18	0.2	0	0
	-0.1	11	0	1	0.2	0	0	0.2	0.2	0	0
				1							

Click the first tab "Specifications" once again, and use the button "Deselect All" in the bottom left corner of the window to clear the list. You will then select the variables that are of interest by checking the boxes in the left margin.

View Result o	f Scenario.1	
Specificat	ions Plot Table	
Filter:		
Time (s)	Parameters	_
	Scenario.1/Law Excitation.1/Result/Length	
	Scenario.1/Position,Speed and Acceleration.1/X_Vertex	
	Scenario.1/Position,Speed and Acceleration.1/V_Vertex	
	Scenario.1/Position,Speed and Acceleration.1/Z_Vertex	-
	Scenario1/Position,Speed and Acceleration1/X_LinearVelocity	-
	Scenario.1/Position,Speed and Acceleration.1/V_LinearVelocity	
	Scenario.1/Position,Speed and Acceleration.1/Z_LinearVelocity	
	Scenario.1/Position,Speed and Acceleration.1/LinearVelocity(Magnitude)	
	Scenario.1/Position,Speed and Acceleration.1/X_LinearAcceleration	
	Scenario.1/Position,Speed and Acceleration.1/V_LinearAcceleration	
	Scenario.1/Position,Speed and Acceleration.1/Z_LinearAcceleration	
	Scenario1/Position,Speed and Acceleration1/LinearAcceleration	
	Scenario1/Position,Speed and Acceleration1/X_AngularVelocity	
	Scenario.1/Position,Speed and Acceleration.1/V_AngularVelocity	
	Scenario:1/Position Speed and Acceleration.1/Z AngularVelocity	-
Select All	Deselect All	New Curve

The geometry/orientation in the present problem is such that the block travels along the "Xaxis." This being the case, check the following three boxes.

Time (s)	Parameters				
	Scenario.1/Law Excitation.1/Result/Length				
	Scenario.1/Position,Speed and Acceleration.1/X_Vertex				
	Scenario.1/Position,Speed and Acceleration.1/Y_Vertex				
	Scenario.1/Position,Speed and Acceleration.1/Z_Vertex				
	Scenario.1/Position,Speed and Acceleration.1/X_LinearVelocity				
	Scenario.1/Position,Speed and Acceleration.1/Y_LinearVelocity				
	Scenario.1/Position,Speed and Acceleration.1/Z_LinearVelocity				
	Scenario.1/Position,Speed and Acceleration.1/LinearVelocity(Magnitude)				
	$eq:scenario.1/Position,Speed and Acceleration.1/X_LinearAcceleration$				

liew Result of	Scenario.1	00	1 83
Specificati	ors Plot Table		
Fifter:	All		
Time (s)	Parameters		- A
	Scenario1/Law Excitation1/Result/Length		
	Scenario1/Position,Speed and Acceleration.1/X_Vertex		
	Scenario1/Position,Speed and Acceleration.1/Y_Vertex		
	Scenario.1/Position,Speed and Acceleration.1/Z_Vertex		
	Scenario1/Position,Speed and Acceleration.1/X_LinearVelocity		-
	Scenario.1/Position,Speed and Acceleration.1/Y_LinearVelocity		
	Scenario1/Position, Speed and Acceleration.1/Z_LinearVelocity		
	Scenario1/Position, Speed and Acceleration.1/LinearVelocity(Magnitude)		
	Scenario1/Position, Speed and Acceleration.1/X_LinearAcceleration		
	Scenario1/Position, Speed and Acceleration.1/Y_LinearAcceleration		
	Scenario1/Position, Speed and Acceleration.1/Z_LinearAcceleration		
	Scenario1/Position, Speed and Acceleration.1/LinearAcceleration		
	Scenario1/Position, Speed and Acceleration.1/X_AngularVelocity		
	Scenario1/Position, Speed and Acceleration.1/Y_AngularVelocity		
	Scenario1/Position Speed and Acceleration.1/Z AnoularVelocity		_
Select All	Desetect All	New C	urve
		_	

Now select the "Plot" tab from this window. You will see the plot of position (parabolic curve), velocity (the linear curve), and the acceleration (flat line) are displayed.

	,		6.9	0.4 Time	0.6 (s)	0.8	1.0
	9.196 0.0	0.10				+	
	0.105 0.3	s.o =					
	0.200 - 200 0.1 (e PO 	9.00 P		*			
	6-6	E 0.04			\rightarrow		
esite 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.2	9 8205 0.1	- 0.00					
	0.2 0.2	20- 0.20		L		· · · · · · · · · · · · · · · · · · ·	

Finally select the "Table" tab to see the stored values.

fiew Resul	t of Scenario.1	Acres Samera		
Specifi	ations Plot	Table		
Time () Length [X_LinearVelocity [P	X_LinearAcceleration [
0	0	0	0.2	
0.1	-0.001	0.02	0.2	
0.2	-0.004	0.04	0.2	
0.3	-0.009	0.06	0.2	
0.4	-0.016	0.08	0.2	
0.5	-0.025	0.1	0.2	
0.6	-0.036	0.12	0.2	
0.7	-0.049	0.14	0.2	
0.8	-0.064	0.16	0.2	
0.9	-0.081	0.18	0.2	
1	-0.1	0.2	0.2	
			13	

The above generated graphs are the selected variables plotted as a function of time. It is also possible to generate graphs of any two variables against each other. On the next page, the graph of x-position of the Block against the x-velocity of the Block is generated.

Select the button "New curve..." in the bottom right margin of the window "View Results Scenario.1."

Vie	w Result of	enario.1	23
lſ	Specificati	s Plot Table	
Ш	Filter:	All	
Ш	Time (s)	rameters	<u>^</u>
ш		enario.1/Law Excitation.1/Result/Length	
		enario.1/Position,Speed and Acceleration.1/X_Vertex	
		enario.1/Position,Speed and Acceleration.1/Y_Vertex	
ш		enario1/Position,Speed and Acceleration1/Z_Vertex	=
ш		enario.1/Position,Speed and Acceleration.1/X_Linear/elocity	
		enario.1/Position,Speed and Acceleration.1/Y_Linear/velocity	
ш		enario.1/Position.Speed and Acceleration.1/2_Linear/Velocity	
		enario_1/vostion,speed and Acceleration_1/Linearveiocnty(Magnitude)	
ш		enanci/Position.speed and Acceleration I/A_LinearAcceleration enanci/Position.Speed and Acceleration I/A_LinearAcceleration Select "New Curve "	
	Ē.	Remind / Fourier State and Acceleration / Linear Acceleration	
		enario.1/Position Speed and Acceleration.1/LinearAcceleration	
		enario.1/Position.Speed and Acceleration.1/X AngularVelocity	
П		enario1/Position_Speed and Acceleration_1/Y_AngularVelocity	
ш		enario1/Position Speed and Acceleration1/Z AngularVelocity	-
ш	Select All	Deselect All New Curr	ve
Ľ			

The "X-Y Selection" window pops up. From the available menus, choose the variables shown below.

X & Y Selection	? X
X: Length [Result/Law Excitation.1/Scenario.1] (Inch)	•
Y: Length [Result/Law Excitation.1/Scenario.1] (Inch)	·
	OK Cancel



The result will be a plot of the x-position of the Block vs. the x-velocity of it. Click on "OK" to close the dialogue box and generate the desired graph.



