Sequences

Sequences have been enhanced: we recommend you to read the Sequence section in its overall to discover more about:

- scheduling actions: "iterative create last step and add" mode
- interface change for action duration
- Delay option
- Color and transparency actions
 To have a look, please click on the appropriate keyword in the What's New section (items under Sequences)

About sequence capabilities: provides background information about sequence capabilities.

Sequence editor: provides information about the sequence editor Display Gantt chart: provides background information about the Sequence Gantt Chart.

Define a sequence: Click the Edit Sequence icon, add actions, sequence them, modify the actions duration if necessary. Click the Edit Analysis tab and add interferences and distances. When satisfied click OK.

About Sequence Capabilities

A sequence is a way to put together and schedule actions to perform simulations.

Sequences are persistent and can be stored in your document.

What is an action?

Actions are entities of different nature organized within the sequence. They can be objects from the following list:

- tracks (camera tracks, product tracks, shuttle tracks, section plane tracks, light tracks) please refer to About **Tracks Capabilities**
- color and transparency actions



- visibility actions i.e. Show/Hide
- simulations (R6 simulations)
- sequences (
- FEA Analysis

Please read "DMU Engineering Analysis Review"- Animating Images

mechanisms which can be simulated with laws

Please read "Running Mechanisms within a Sequence" in the DMU Kinematics Simulator User's Guide About actions duration:

Actions are characterized by a duration:

i.e. Track duration is linked to the trajectory length

About Visibility and color actions

Using a a color/transparency action, you could only define an initial and a final state. This highlight aims at offering more capabilities for Color/Transparency actions based on the track model:

- recording of multiple states for the same action using the standard graphic properties toolbar.
- possibility to change the object on which is applied the action
- recording capabilities using the same Recorder tool than the track
- time edition of the action (possibility to change the duration of each segment).
- VB exposition 0
- The visibility or color actions are created in sequence context and their effects are seen only when you use the Player (in the sequence for instance)
- color and transparency actions have now a duration
- Visibility actions are instantaneous (duration=0) 0
- For more information, please refer to Defining a Sequence

Initially the product looks like this:



when creating a color action in the sequence, it becomes:



Make sure though, you schedule this action properly using the Action Delay parameter (i.e. depending on the effect you want to obtain)

The picture below gives you the various results after action creation according to the option set:



Sequence time chart

This duration is recovered in the sequence but you can also apply a specific duration in sequence context.

Example:

Duration in the player of a sequence comprising two tracks: The two actions are scheduled to start one after the other (see: sequencing modes)

Beginning





About Action Modification

You can modify the action duration, all you need to do is:

- select the action in the Actions in Sequence list
- Enter the new value in the action duration (i.e. 200)
- If you need a delay, enter a value in the Action delay field (i.e. 400)
- You can use the Reset button to swap to the default action value (intrinsic duration)

Ec	dit Sequence		? ×
	Edit Action Edit Analysis		
	Action in session	Action in Sequence	
	Track.1 (Track.1) Track.1 (Track.2) Color Action.1 (Color A Visibility Action.1	Step Action 1 Track.1 (Track.1)	
	⇒	2 Track.1 (Track.2)	
	-	3 Color Action.1 (Color Action	.1)
		1	
		Move Up	Merge Up
		Move Down	Merge Down
		Action duration (s) 200 🚔 Rese	et duration Action delay (s) 400
	Action add mode		
	Create last step and add	○ Add in last step	O Iterative create last step and add
			OK Cancel

Action duration (s) 0.99717	Reset duration Action delay (s) 400	-
	201	

About sequencing

Sequencing aims at defining a time frame within which the actions are scheduled.

Two sequencing modes are available:

- actions start together (simultaneous mode)
- actions start right one after the other (consecutive mode)

Simultaneous mode





You can combine the two modes and modify the scheduling at any time.

Sequences lets you put together existing actions, anyway, you can easily create a new action on the fly and add it in the current sequence. This capability lets you edit actions in context and synchronize meeting points in different actions.

The example below illustrates the two modes combination:

Simultaneous mode



About Journaling/automation

Sequences are journalized. You can generate a macro using Tools->Macro->Record... (see the Infrastructure user's Guide)

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Sequence creation:

3 methods are available to create sequences:

1. There are existing actions in your document (actions in session list),

Click the Sequence icon , and add them using the arrow into the Action in sequence list and schedule them, using the sequencing tools (Refer to: Sequence editor)

- 2. Open an empty sequence and create actions on the fly (the sequence editor remains opened)
- 3. Combine the two methods (1. and 2.)

Sequences created in this manner are persistent and can be stored in the document. They are listed as separate entities in the specification tree and can be selected at any time and modified.



Sequence Editor

The sequence editor lets you manage and simulate actions from the following:

- moving objects (part, camera, ...)
- graphic attributes (show/hide, colors, transparency)

you can also manage time with Gantt chart

Let's look at it more carefully:

The Edit Sequence dialog box comprises of two tabs:

- Edit Action tab
- Edit Analysis tab

Edit Action Edit Analys	sis	
ction in session	Action in Sequence	
	Move Up	Merge Up
	Move Up Move Down Action duration (s)	Merge Up Merge Down et duration Action delay (s)
Action add mode	Move Up Move Down Action duration (s)	Merge Up Merge Down et duration Action delay (s)

The Edit Action tab lets you perform the following operations:

Add/remove actions using the green arrows



Edit Action Edit Analysis		2 ×
here and a second secon		
Action in session	Astion in Sequence	
Teach 1 (Trach 2)	Step Action	Duration (s) Delay (s)
Color Action. 1	1 Track,1 (Track,1)	691.728 0
	n	
-		
-	2. Click Add 3. The	e action is added in the current sequence
	Move Up	Merge Up
	Move Down	Merge Down
× >	Action duration (s) 691.73	Reset duration Action delay (s)
Action add mide	O Add in last step	O Iterative create last step and add
	a restanting	
		OK Scancel
1. Select action		
2. Select an action a	and click . The action is remov	ved from the "Action in Sequence" list
2. Select an action a	and click . The action is remov	ved from the "Action in Sequence" list
2. Select an action a	and click . The action is remove	ved from the "Action in Sequence" list
2. Select an action a Edit Sequence Edit Action Edit Analysis	and click . The action is remove	ved from the "Action in Sequence" list
2. Select an action a Edit Sequence Edit Action Edit Analysis Action in session Track 1 [Track 1]	and click . The action is removed	ved from the "Action in Sequence" list
2. Select an action a Edit Sequence Edit Action Edit Analysis Action in session Track 1 (Track 1) Track 1 (Track 2) Color Action 1 (Color A	And click . The action is removed	ved from the "Action in Sequence" list
2. Select an action a Edit Sequence Edit Action Edit Analysis Action in session Track,1 (Track,1) Track,1 (Track,2) Color Action,1 (Color A-	and click . The action is removed	ved from the "Action in Sequence" list
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2. Select an action a Edit Sequence Edit Action Edit Analysis Action in session Track.1 [Track.2] Color Action.1 [Color A	And click . The action is removed	ved from the "Action in Sequence" list
2. Select an action a Edit Sequence Edit Action Edit Analysis Action in session Track 1 (Track 1) Track 1 (Track 2) Color Action 1 (Color A	And click . The action is remove	ved from the "Action in Sequence" list
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2. Select an action a	And click . The action is remove	ved from the "Action in Sequence" list
2. Select an action a	And click The action is remove	ved from the "Action in Sequence" list
2. Select an action a	And click The action is remove Step Action 1 Teck 1 (Track 1) 2. Click Remove Move Up Move Up Move Down Action duration (s) [591.73	ved from the "Action in Sequence" list

Note: If you multi-select actions in the session list and click the Add button, the actions are added in simultaneous mode.

- Customize the add mode settings:
 - (1) Create last step and add option: creates a last step and add the selected action into it .(default mode) (in consecutive mode)
 - (2) Add in last step option: lets you add an action in last step (in simultaneous mode)

a new add mode appears

(3) Iterative create last step and add option: lets you add the actions in consecutive steps (1-2-3...)



Sequence actions using:

if working in consecutive mode

- Move up: moves up a selected action
- Move down: moves down a selected action

if working in simultaneous mode

- Merge up: merges the selected action up
- Merge down: merges the selected action down

Note: remember you can combine the two modes within the same sequence. Please read About Sequence Capabilities

- Customize the action duration
 - action duration: the numerical field lets you enter a specific duration for an action (this capability enables to simulate the same action with a different time scaling)
 - **reset duration:** lets you reset the selected action to its intrinsic duration

Action duration (s) 200	÷	Reset duration	Action delay (s) 400	٢
Action duration (s) 691.73	a	Reset duration		
		Reset default duration		
Note: you can enter a specific (duration for al	l action types exce	nt visibility actions wh	hich are

Note: you can enter a specific duration for all action types except visibility actions which are instantaneous (duration=0)

Action duration (s)	0
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- A new option is available :
 - action delay: lets you delay the starting time of an action (i.e. it is now possible to overlap two actions)

For instance, two tracks within the same sequence step can be synchronized, in order to achieve passing by specific waypoints simultaneously.

For all actions contained in the sequence, the delay is a time attribute, just like their duration. It means the action will start with respect to the specified delay with the theoretical beginning of the step, which the action belongs to. Valid delay values are zero or positive.



Delay

The actions appear in the "Action in sequence" list, they are scheduled in steps and their duration and delays are displayed.

Note: To apply a delay to an action or modify it, all you need to do is select the required action in the Action in session list and enter a value in the Action delay field:

Edit Sequence			? ×
Edit Action Edit Analysis	1		
Action in session Track.1 (Track.1)	Action in Sequence	Duration (s)	Delay (c)
Track.2 (Track.1) Color Action.1	1 Track.1 (Track.1)	5	2
-	2 Track.2 (Track.1)	142.396	0
+			
	Move Up	Merge Up	
	Move Down	Paret duration (action delay (s) 2	
Action add mode		Action delay (5)	
Create last step and add	O Add in last step	O Iterative create last st	ep and add
		• ок	Cancel

Eo	lit Sequence						?	×
	Edit Action Edit Ar	alysis						
	Analyses in session		Analyses in	Sequenc	e			
	Interference.1		Analyses	Status	Step			
	Distance.1							
	Distance.2							
		4						
			Cotallus	potiuo I	Cotoll	potiuo I	Cot all stop	
	J		Secalium	acuve	Secali	active	Set all stop	
							1	
) OK	Canc	el

The Edit Analysis tab lets you perform the following operations:

- Add/remove interferences or distances using the green arrows
 - 1. Select an analysis in the "Analyses in session" list and click add. The action is added in the sequence list.
 - 2. Select an analysis in the "Analyses in Sequence" list and click remove

Note: you can add existing interferences or distances or create them on the fly (in this case they are automatically displayed in the "Analyses in session "list

- Set the clash detection mode
 - Set all inactive option: (default mode) as you simulate your sequence, the detection is set to off, the interferences and/or distances defined in your sequence are not taken into account
 - Set all active option: as you simulate your sequence the detection is set to on, the interferences and/or distances defined in your sequence are taken into account
 - Set all stop option: as you simulate your sequence, the detection is set to stop (on collision), the simulation stops when an interference defined in your sequence is detected. The distances defined remain active.

About Editing an action and analysis

Double-click actions, interferences, distances to display the dedicated editor. Perform the required modifications, the modifications are automatically taken into account in the Edit Sequence dialog box.



Displaying Gantt Chart

This task shows you how to display the Gantt Chart viewer.

A Gantt chart allows users to do a basic, overall cycle-time analysis for a set of actions. The Gantt chart visualization is based on the cycle time parameter defined in each action.

About Gantt Chart:

The Gantt chart is another way to visualize your sequence. Note that you cannot modify the action duration using the Gantt window.

A Gantt chart is bar graph of a sequence. It shows start and stop times as well as dependencies. The Gantt chart is a 2D view of the sequence process.

Open the CHAINSAWAT.CATProduct document

A sequence is defined

1. Select a sequence in the specification tree:

for instance Sequence.4



Gantt Chart for multiple sequences in a single Gantt Chart are not supported

2. Select Window->New Gantt Chart Window



The Gantt chart window is displayed:

Activity	Duration	BeginTime	EndTime	0s 1	10s	20s	30s	40s	50s
-Sequence.4	49.25	0.00	49.25						-
Start.1	0.00	0.00	0.00	•					
Action.1	49.25	0.00	49.25						
Stop.1	0.00	49.25	49.25						٠
Action.2	35.00	0.00	35.00						
				!			-	-	
×			Þ	•					

Let's describe it more carefully:

- The left frame of the Gantt chart lists each of the individual actions and /or analyses that exist in your document, displaying the duration, start time and end time for each.
- The right frame provides a graphical representation of each action or analysis (along the line of time) which also indicates the start, duration and end of each.
- A dashed vertical line in the right window (called the Time Line), provides a visual indication of the current time during the execution.

You can easily modify the action duration within the Gantt Chart, stretching the action graphical representation, the Gantt Chart as well as the Edit sequence dialog box are automatically updated.

For instance, double-click a sequence in the specification tree. You are in the sequence command.

Then select Window->New Gantt Chart Window:

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letivity	Duration	BeginTi	EndTim	OB I	108	208	308	408	508	608	708	808	908	1008
Sequence.4	49.25	0.00	49.25		-	-		-	•	1	1	1	1	-
Start.1	0.00	0.00	0.00			D	E	D	[
Action.1	49.25	0.00	48.25											
Stop.1	0.00	49.25	49.25	_					ŧ					
Action.2	35.00	0.00	35.00	_										1
														-
E di Action in s Track.1 (Dutchece Handle S Track.5 (Safety, H Track.5 (Color Act Vribility A Sequeno Sequeno Sequeno Sequeno	n Edit Avr ession Frack. 1] ever, Track. [Tr huttle_Track. 1] frack. 1] andle_Track. frack. 1] andle_Track. frack. 1] andle_Track. s.0 block the and last step and	olpcia Act 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ion in Sequence typ / Acti Tri Se	an Ick. 7 (Track. querce. 3 Move Up Move Down	1) Last step		Recet	duration	M	Harge U erge Do Iction de rative co	P eate last	ation [s]	i ital	
				=						_	OK	<u> </u>	Cancel	}

• •	Do 2	- HA H	1.	P. H. H	1. 31	_	_	_				
Activity	Duration	BigisTi	EndTim	-	908	206 31	1 1	1000	70	- 80e	1008	1008
Sequence.4	65.75	0.00	65.75			1					1	1
Start.1	0.00	0.00								1		
Addon.1	65.75	0.00	6.75		-	ALC: NO.	NO. OF STREET, ST	0.000		- 1		
Skop.1	0.00	65.75	65.75						٠	1		
Action.2	35.00	0.00	35.00									
	_			_	-			-				- 1
Clubble Handla Tuels 3 Selety Tuels 7 Color & Vability Sequer Sequer	over, Track (Track (Track (Track T) (Track T) (Track T) (Track T) (Track T) (Track (Track T) (Track (Track T) (Track (Track T) (Track T)	•	Ton-duration (or	Nove Up	0 B		ewet duratio	H Ne	arge Up ge Down tion-delay (s	6 ⁷⁵		
											Cancel]
				-[-								

It does work, the other way round: modifying the action duration within the Edit Sequence updates the Gantt Chart window automatically



Defining a Sequence



This task shows you how to define a sequence

Open the DEFINE_SEQUENCE.CATProduct document. Tracks are already defined

- Click the Edit Sequence icon in the DMU Simulation toolbar
 The Edit Sequence dialog box is displayed
 - 2. Select Track.1 (Track.1) in the action in session list and click
 - 3. Select Track.1 (Track.2) in the action in session list and click

Edit Sequence				? ×
Edit Action	Edit Analysis			
Action in session Track.1 (Track. Track.1 (Track.	1) 2)	Action in Sequence Step Action Track.1 (Track.1) 2 Track.1 (Track.2)	Duration (s) 691.728 691.728	Delay (s) 0 0
		Move Up Move Down Action duration (s)	et duration Ar	Merge Up Merge Down ction delay (s)
Action add mo	de			
Create last st	tep and add	O Add in last step	O Itera	ative create last step and add
				OK OK

The Sequence.1 is identified in the specification tree



you want them to start together

4. Click Merge Up button

E	dit Sequence		? ×
	Edit Action Edit Analy Action in session Track.1 (Track.1) Track.1 (Track.2)	sis Action in Sequence Step Action 1 Track.1 (Track.1) 1 Track.1 (Track.2)	
		Move Up	Merge Up
		Move Down	Merge Down
		Action duration (s) 691.73 Reset	duration Action delay (s)
	Action add mode		
	Create last step and ad	ld O Add in last step	O Iterative create last step and add
			OK Cancel

The two actions will start together

Note: you could have selected both (simultaneous mode) in the action in session list.

5. Check the "Add in last step" option in the Edit Sequence dialog box (Create last step and add option is set by default)



6. Add a color action (you are going to create it on the fly), for this

Click the Color action icon icon icon fin the DMU Simulation toolbar The Color Action edition dialog box appears

Color Action			? ×
🔒 Object:	No selection		Edit 🚯
Interpolater:	Linear	•	More>>
		🌖 ОК	Cancel

7. Select Handle.1 either in the specification tree or in the geometry area



The Graphic Properties toolbar appears

8. Select a color of your choice using the arrow and combo list. For instance blue

Graphic Properties			×
	▼ No Widt ▼ No Line ▼ ×	None	.

9. Click Record

10. Set the transparency, for this:

- click the Edit button <u>Edit</u> in the color action dialog box
- select the Graphic tab in the Properties dialog box displayed
- check the transparency option if needed, and move the slider as desired

Note: you can access the Properties dialog box at any time to change color, transparency. The Graphic Properties toolbar a quicker way to modify graphic properties.

Properties	? X
Current selection : All	-
Product Graphic Mechanical Drafting	
Graphic Properties	1
Color Linetype Thickness	
No Line Type No Width	
Transparency 44	
Show Pick and LaWs	
L Shown	
Pickable	
LowInt	
None	
Mo	e
OK Apply Clo	se

- **11.** Click Apply, when done, click close to exit the Properties dialog box
- 12. Click Record
- **13.** Click Ok in the Edit Color Action dialog box when you are satisfied.



The color action is automatically added in the action in the sequence and identified in the specification tree

Step	Action	Duration (s)	Delay (s)
1 1	Track.1 (Track.1) Track.1 (Track.2)	691.728 691.728	0
1	Color Action.1 (Color Action.1)	0.99717	0



14. Modify the action duration if necessary

For more detailed information, please read: About Action Modification

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Enter 200 in the Action duration field

Action duration (s) 200

15. Select the Color Action.1 in the action list and modify its delay:

enter 400 in the Action delay field

Action in 5	equence				
Step	Action			Duration (s)	Delay (s)
1	Track.1 (Track.1)			691.728	0
1	Track.1 (Track.2)			691.728	0
1	Color Action.1 (Color Action.1)			200	400
	Move Up			Merge Up	
	Mous Down			Maran Davie	
	MOVE DOWN			Merge Down	
Action du	ration (s) 200 🛛 🗧	-	Reset duration	Action delay	<mark>y (s)</mark> 400 🛛 🛃
					N

16 Play your sequence if needed using the Player

Now add analyses in your sequence for validation purposes

17. Click the Edit Analysis tab



- 18. Multi-select the existing analyses (i.e. Distance.1 and Interference.1) and click _____. Note: you can create and add analysis specifications on the fly. You can also edit existing analysis specifications, double-clicking them in the "Analyses in sequence" list
- **19.** Click Set all active button

dit Sequence				2
Edit Action	Edit Analysis			
Analyses in se	ssion	Analyses in Sequence	and strength	and the second
		Analyses	Status	Step
		Analysis.5//Distance.1	active	al
		Analysis.6//Interference.1	active	al
				8
		1		
		J		
		Set all unactive Set a	allactive	Set all stop
				Cancel
			UN UN	Canca

20. Click Ok in the Edit Sequence dialog box when satisfied.

21. Select your sequence in the specification tree and click the player icon

22. Simulate your sequence using the DMU Player buttons.

23. If you need to restore the initial positions, click the Reset icon 23. **24.** Open the DEFINE_SEQUENCE_RESULT.CATProduct to check your result



