RECURDYN

What's New in RecurDyn 2023

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Professional

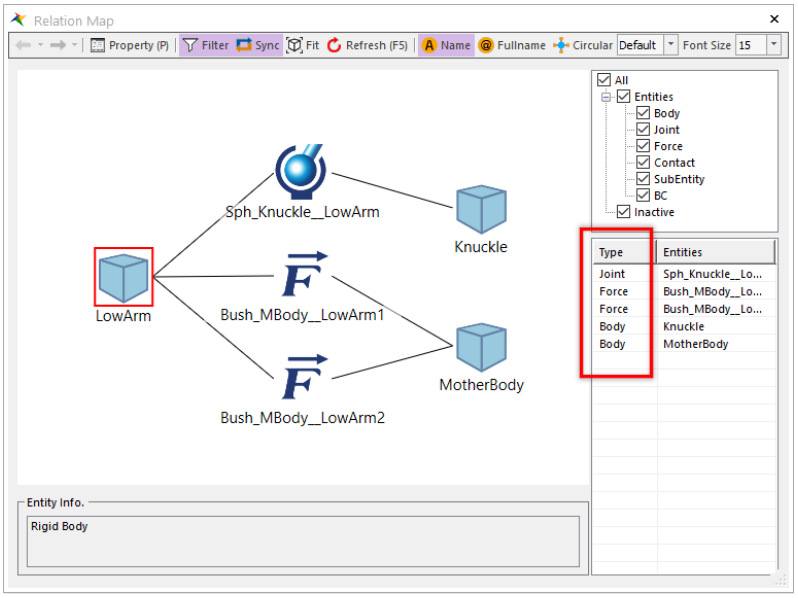
Convenience Enhancements

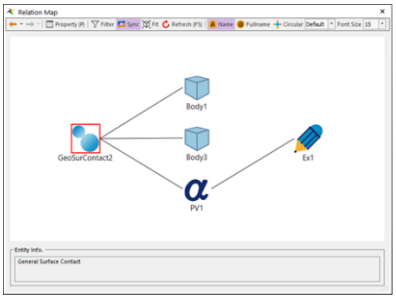
Product	Professional
New/Improved	Improved
Location in User Interface	-
Location in Manual	-

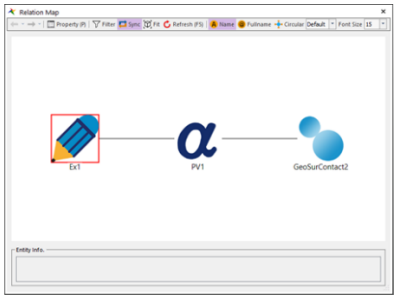
Description

Various features have been improved to be more convenient to use, in both pre-processing and post-processing.

- Relation Map: The Filter function allows you to identify the types of entities in the entity list. Also, it is now possible to check the connection relationship of Expressions in the Relation Map.

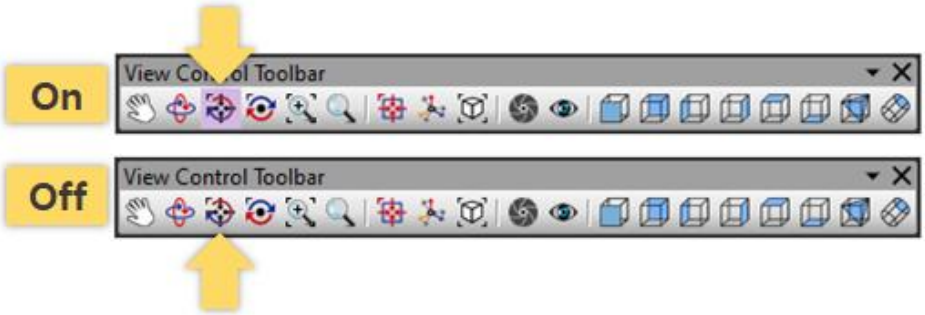






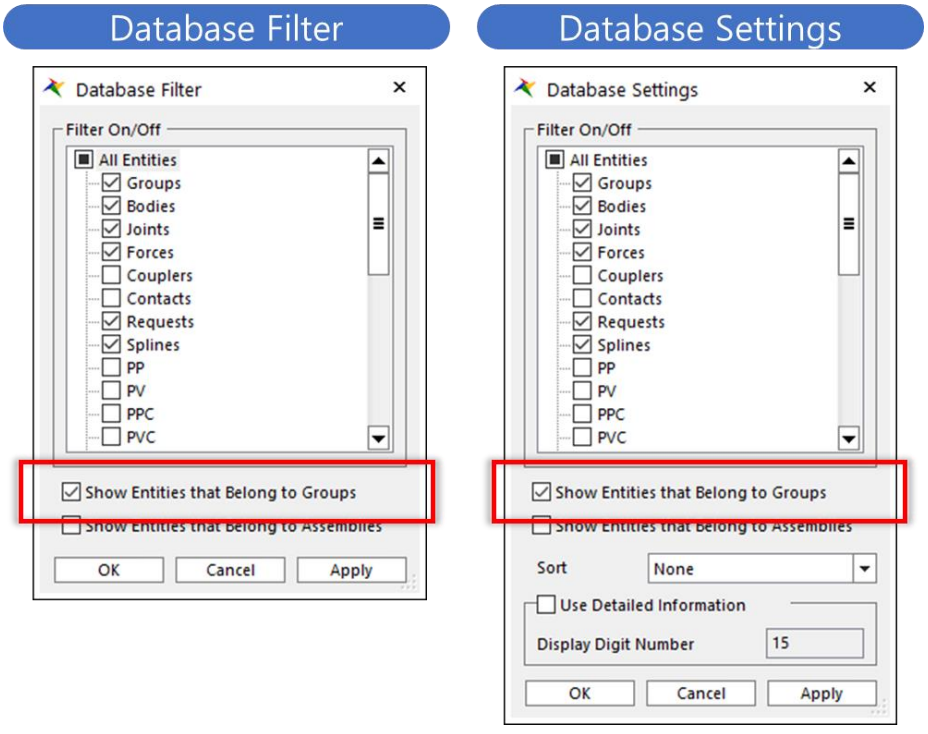
- A newly added feature allows the users to specify a rotation point and keep the rotation point until it is turned off. In the case of the existing 'Rotate with Point' or 'View Center' function, even if the users specify a point, when the working plane or view plane is changed, the assigned point is automatically released. With the newly developed 'Rotate with Predefined Point' function, the point the users have defined will remain the same until it is turned off by the users.

  - Rotate with Predefined Point On/Off: Click the icon in the View Control Toolbar to change its state to 'On' and specify a user-defined point via the mouse cursor or Command Toolbar. By clicking the icon once more, this feature is turned off and the rotation point returns to its default state.

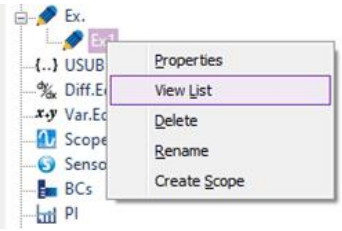


- Show Entities that Belong to Groups: An option to hide objects belonging to a group from the database has been added. It can be set in Database Filter and Database Settings.

- Show Entities that Belong to Assemblies: An option to hide objects belonging to assemblies such as Track and Chain from the database has been added. It can be set in Database Filter and Database Settings.

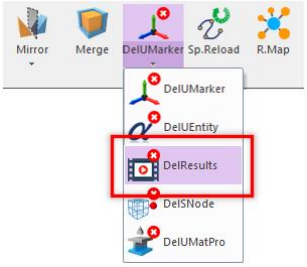


- SubEntity related function improvement in the Database: In the case of SubEntity with an individual dialog box, it is now possible to make it easier to modify (SubEntities include Requests, Strings, Expressions, Splines, Variables, Differential Equations, Design Variables, and Performance Indices).

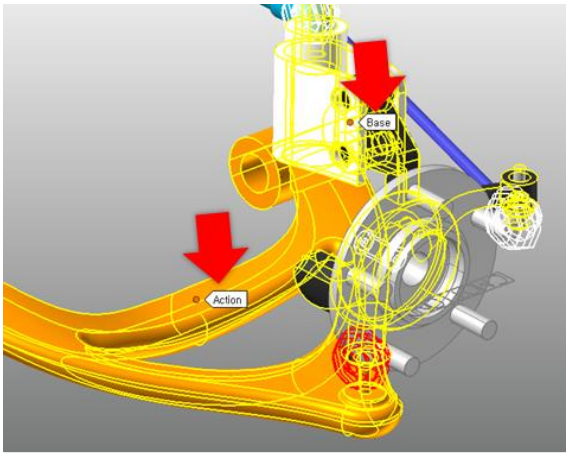


  - View List: View List has been added to the right-click menu for SubEntity in the Database so that the list of the SubEntity can be opened directly.
  - Properties: Properties displayed when right-clicking on a SubEntity in the Database have been changed to open the Edit dialog box of the SubEntity.
  - Double Click: If double-clicking a SubEntity in the Database, the Edit dialog box for the SubEntity is opened.

- Delete Results: A function to delete Animation Data saved in the *.rdyn file has been added. After the Delete Result function is executed, the Simulation Post tasks become inactive. If the size of Animation Data is large, executing the Delete Results function can significantly reduce the size of the *.rdyn file.



- Highlight Tag of Action/Base Body: It is now possible to display tags for the Action Body and the Base Body when Joint, Force, Contact, etc. are selected.

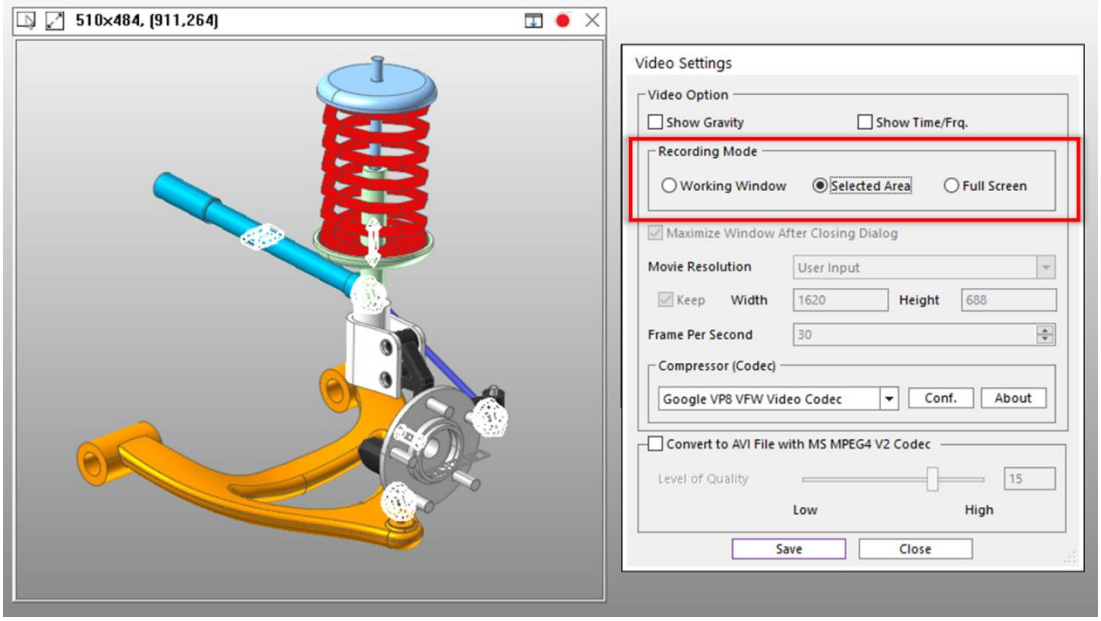


- Shortcut settings for Render Toolbar and View Control Toolbar: The Render Toolbar and View Control Toolbar have been added to Customize, which can be accessed with the right-click menu on the toolbar to set keyboard shortcuts.
- Creation Option for Geo Sphere Contact: The [Solid, Body, Point, Distance] option has been added to be utilized when creating Geo Sphere Contact.
- Creation Option for Fixed Joint: The [Body, Body, Multi Point] option has been added to easily create multiple fixed joints.

- Notification for a duplicate Material name: When a material name is used as a body name, it is now possible to be notified with an error message about material name duplicates.

```
Error No.1048102 <Body2> : Same name already exists. ( Bodies:Body1 )
Error No.1048102 <Body2> : Same name already exists. ( Material:material )
```

- Screen Recorder: The Screen Recorder function has been added to the existing Record. When selecting Select Area or Full Screen in Recording Mode, click the red button on the Recorder Toolbar that newly appears to start recording.
  - Working Window: This method is to record the Animation that is playing within the Working Window in RecurDyn, using the same method as in the previous version.
  - Selected Area: This method is to record the area specified by the user.
  - Full Screen: This method is to record the entire screen, allowing the users to record the various windows such as Scopes in RecurDyn.



- RecurDyn Viewer
  - The Customize function is now available in RecurDyn Viewer.
  - The Scope function is now available in RecurDyn Viewer.
- System Navigator: The Parametric Value Connector and the Parametric Point Connector are now supported in the System Navigator.

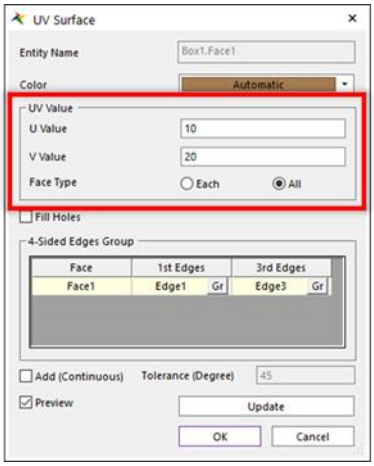
CAD-Related Enhancements

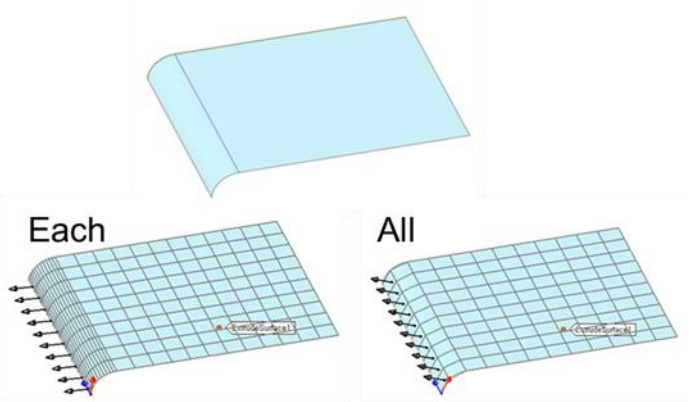
Product	Professional
New/Improved	Improved
Location in User Interface	Body Edit Mode → Geometry tab
Location in Manual	6. Professional → 6.1. Body → 6.1.4. Geometries in Body Edit Mode

Description

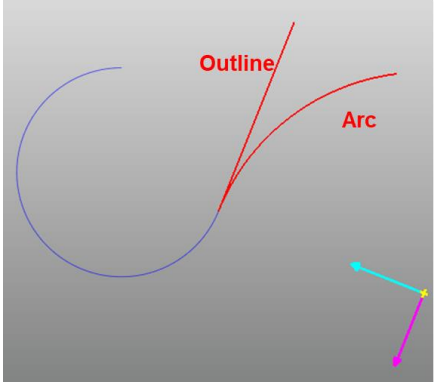
Various enhancements have been made to the CAD-related functions in RecurDyn.

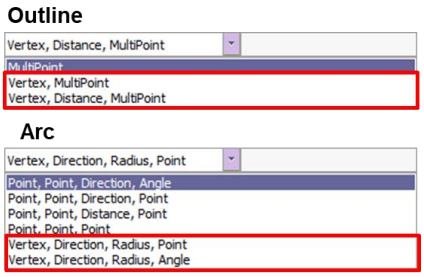
- UV Surface: When creating a UV Surface, a surface composed of multi-faces can be used. In addition, a newly added Face Type (Each or All) option enables adjusting the number of UV patches for each Face.



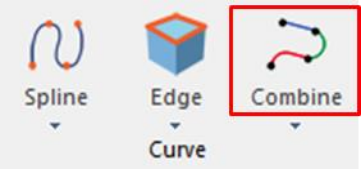


- Arc/Outline: A new creation option now enables the generation of an extension line of an existing arc or outline such that the new Arc or Outline starts from the endpoint of the existing entity and is tangent at the endpoint.
  - Arc: [Vertex, Direction, Radius, Point], [Vertex, Direction, Radius, Angle]
  - Outline: [Vertex, MultiPoint], [Vertex, Distance, MultiPoint]



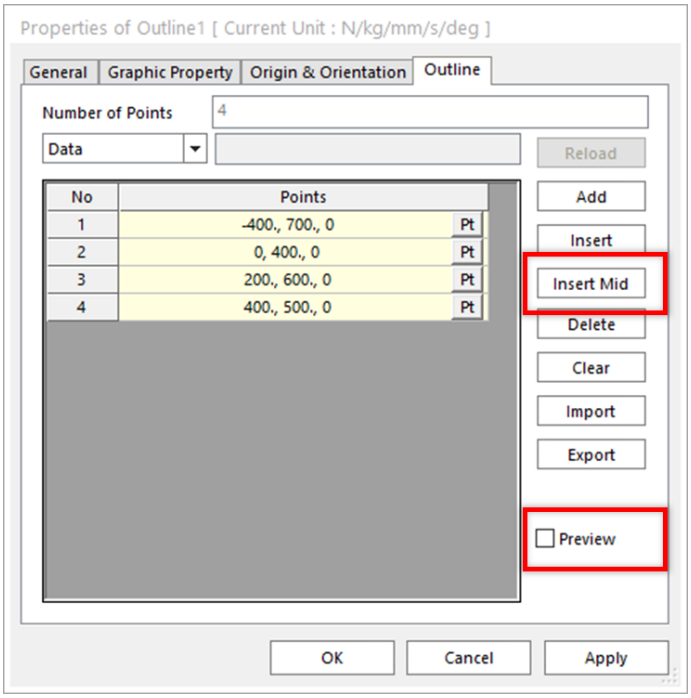


- Combine Curves: It is now possible to combine multiple Curves into a single Curve. The combined curve can be used to create a Surface or a Solid more conveniently.

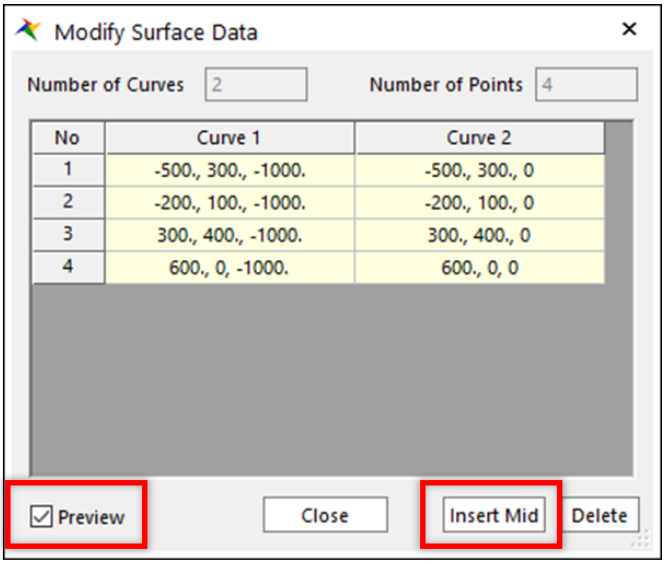


- Fillet Curve: It is now possible to change a sharp corner of a curve into an arc. While a 3D fillet generally rounds off an edge, this 2D fillet rounds off a sharp corner along a curve.

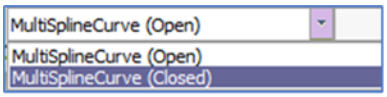
- Midpoint of Outline/Spline: It is now possible to insert Midpoints to the segments of existing Outlines and Splines. In addition, a Preview function for each point, and a function to adjust the first Derivative of the Spline have been added. The use of Midpoints is efficient since the added points can increase the curve's precision.

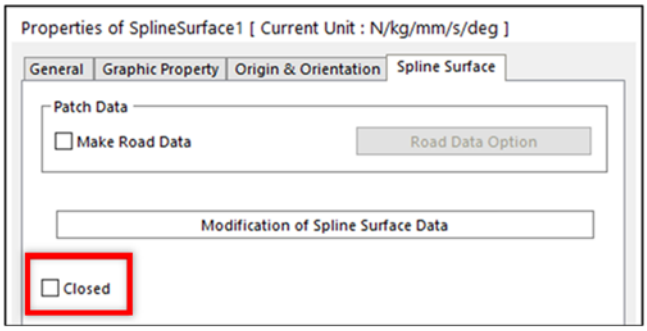


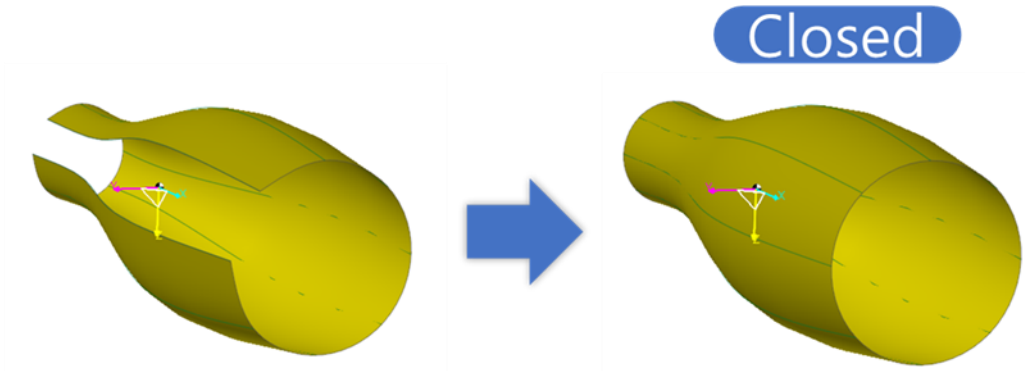
- Midcurve of Outline/Spline Surface: It is now possible to add Midcurve to the existing Outlines and Splines and also see the Preview of the additional points.



- Closed Spline Surface: There is a new option to create a Closed Surface when creating the Spline Surface. Users can also select a Closed Surface option in the Spline Surface dialog box.

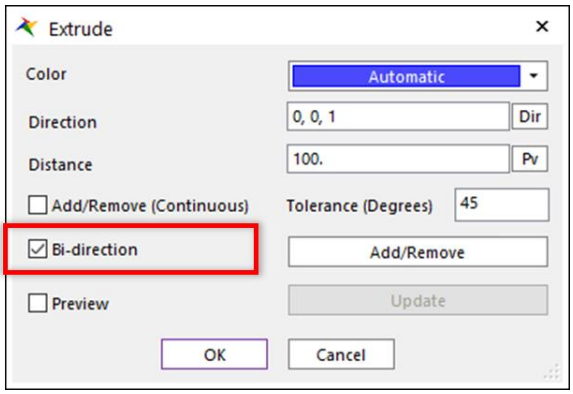




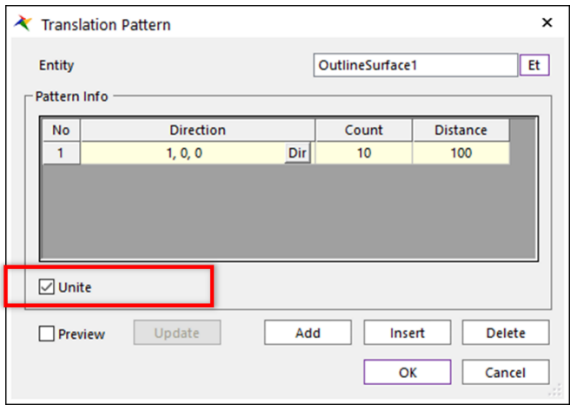


- Twist of Sweep Surface/Solid: A Twist option has been added to the Sweep dialog box in addition to the existing Tangent option.

- Bi-Direction in Extrude: An option to extrude in both directions has been added to the Extrude dialog box of Curve and Surface.



- Unite Option in Translation/Rotation Pattern: When using the Translation/Rotation Pattern function in the Body Edit Mode, it is now possible to automatically convert the created Geometries into a single Geometry using the Unite option.



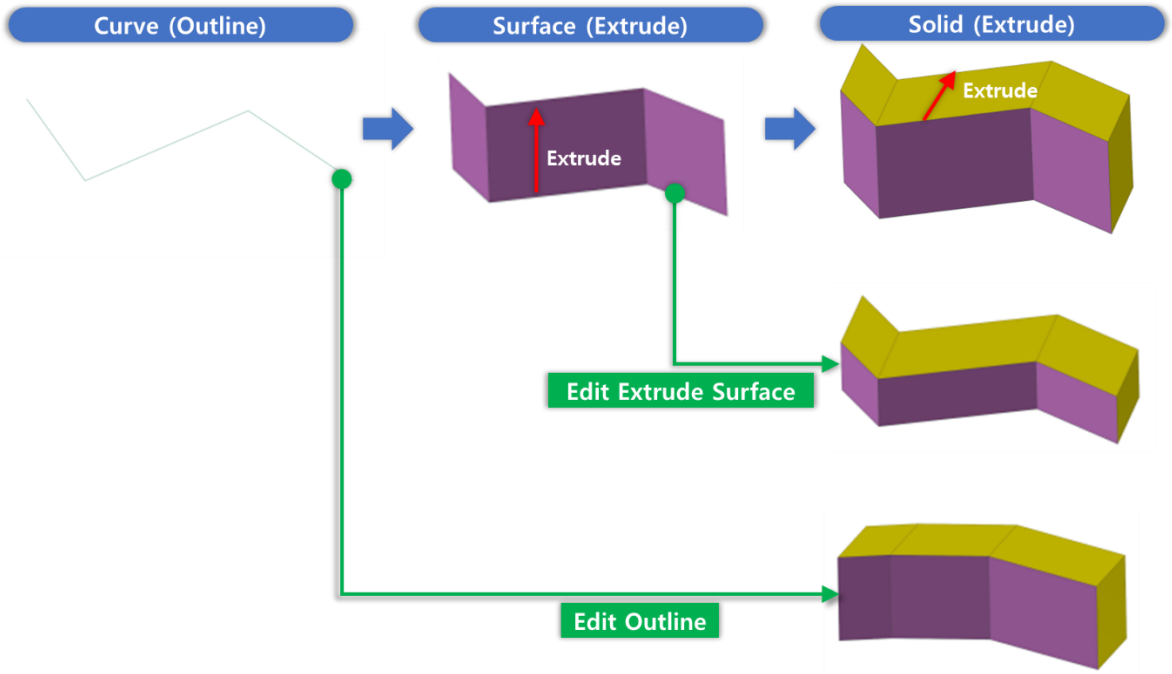
Geometry Update According to Hierarchy

Product	Professional
New/Improved	Improved
Location in User Interface	-
Location in Manual	-

Description

When creating geometry in RecurDyn, the procedure follows the order of Curve → Surface → Solid. In the case of the geometry to which the hierarchy is applied, if the parametric value of the parent geometry is modified, the child geometry is also updated accordingly.

For example, after creating an outline and using it to create a surface with the Extrude Surface command, a modification to the outline also causes a modification to the shape of the surface.



Geometry types to which Hierarchy is applied are as follows.

Curve	Surface	Solid
● Fillet Curve ● Combine Curve	● Extrude Surface ● Spin Surface ● Sweep Surface ● Fill Curve	● Extrude Solid ● Spin Solid ● Sweep Solid ● Fill Surface ● Thicken Surface ● Unite ● Subtract ● Intersect ● Chamfer ● Fillet ● Shell ● Scale

Benefits

If the shape of the curve is modified, the surface or solid is also updated. Therefore, the users can model more diverse shapes in RecurDyn and easily modify them. In particular, if the users use the parametric value or the parametric point, it is now possible to define the shape required for a specific purpose and use it while changing the parameters.

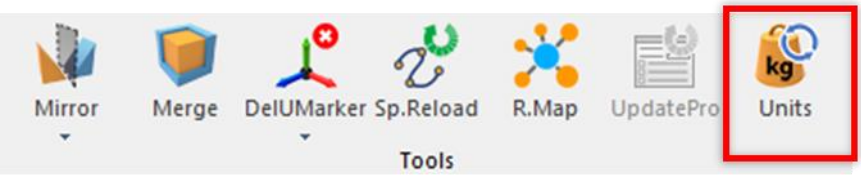
In addition, shape optimization can be achieved through DOE, AutoDesign, etc. by defining the parametric value as a design variable.

Unit Changes in Model

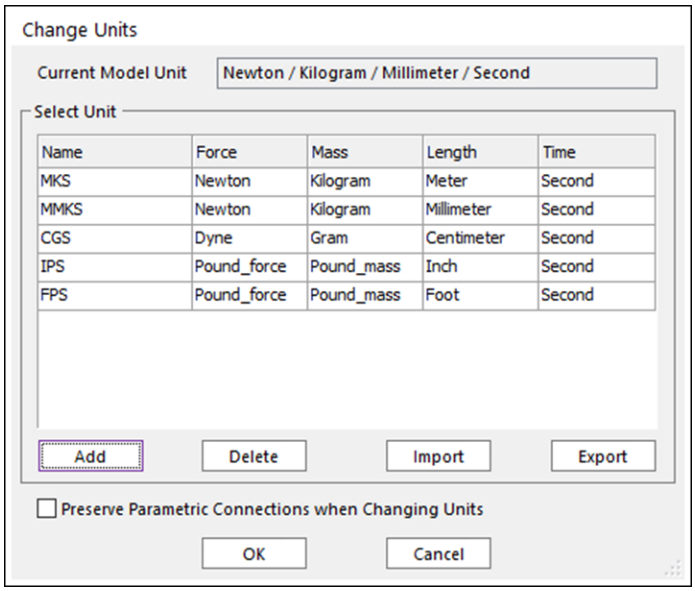
Product	Professional
New/Improved	Improved
Location in User Interface	Home tab → Tools group → Units icon
Location in Manual	3. Home → 3.4. Tools → 3.4.13. Change Model Units

Description

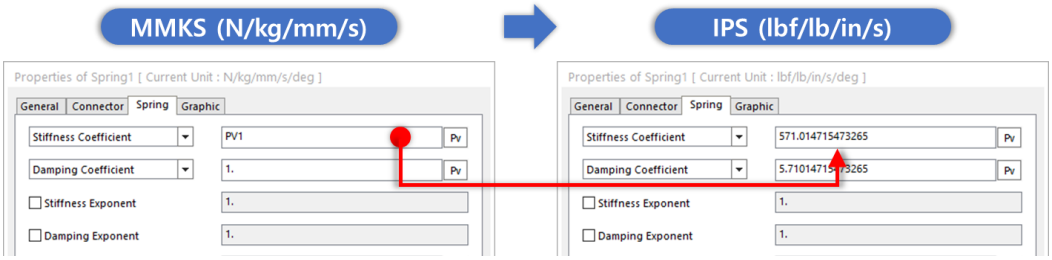
In RecurDyn, it is necessary to specify a system of units when creating a new model. In the previous version, it was not possible to change the unit system of the model once it was set. However, starting with RecurDyn 2023, it is now possible to change the units of the model even after creating the model. The newly added Change Model Units function allows the users to freely change the model units such as Force, Mass, Length, and Time. The user can also create and user-defined unit systems.



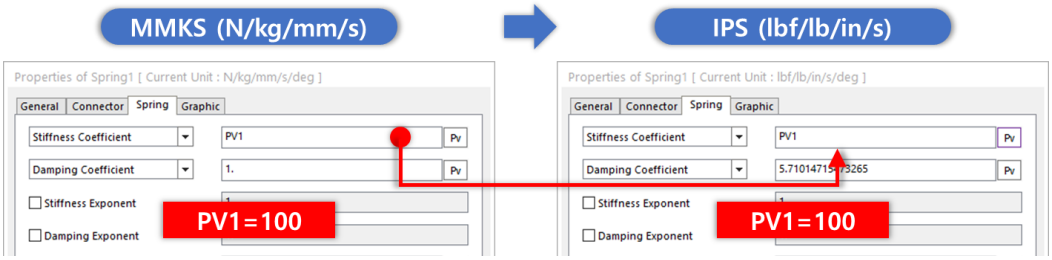
The units of the current model are displayed in the Change Units dialog box. Select the new unit system that you want to change and press the OK button to change the units of the model.



- Preserve Parametric Connections When Changing Units:
  - When it is Unchecked: Any Parametric Value or Parametric Point that is used to define a field with a unit system (such as Stiffness Coefficient and Damping Coefficient), the values are automatically converted and applied according to the units changed. At this time, the PV or PP application is turned off and the converted values are placed in the field as numbers (For the Parametric Point, it is converted to the length unit system).



  - When it is Checked: When the Parametric Value or the Parametric Point is used to define a field with a unit system such as Stiffness Coefficient and Damping Coefficient, the existing PV and PP parameters are maintained even after units are changed. Therefore, for the parameters using the PV and PP, the users may need to modify the PV and PP values manually according to the changed units.



Benefits

It is now possible to change the model unit system according to the users' needs at any time, allowing the convenience to check the result data in the different unit systems. The most effective case where the unit change function can be utilized is when the main system of units used in each country is different. When conducting the technical supports or data exchanges with engineers in other countries, it may be necessary to change the model to the unit system mainly used in that country. In this case, it is now possible to save a significant amount of time since the users can change the unit system of the existing model and use it without creating a new model. As a result, the users need to decide whether to automatically convert all parameter values to the appropriate units instead of disconnecting the PV and PP, or to manually change the values of the PV and PP to match the new units instead of maintaining the PV and PP connection.

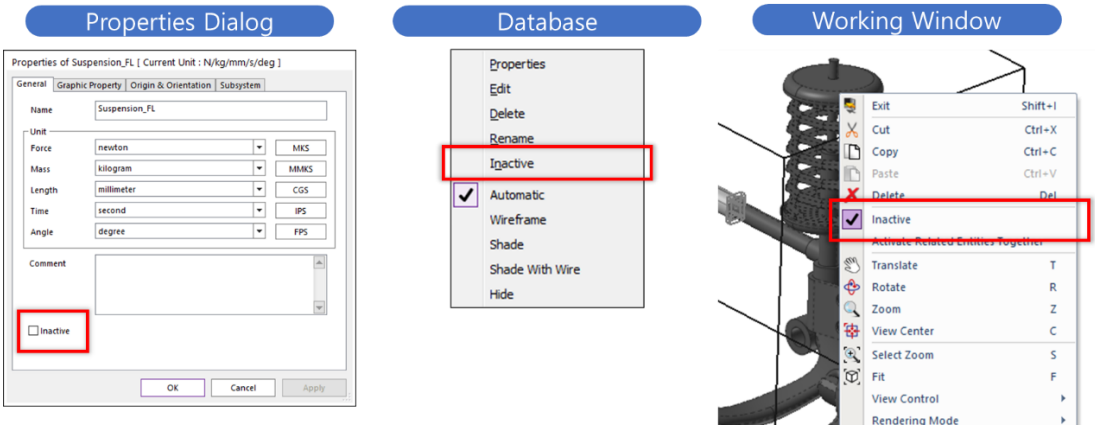
Active/Inactive States for a Subsystem

Product	Professional
New/Improved	Improved
Location in User Interface	Database pop-up menu, Working Window pop-up menu, Properties Dialog > General tab
Location in Manual	2. User Interface → 2.2. RecurDyn Graphic User Interface → 2.2.12. Database Window → 2.2.12.7. Active/Inactive

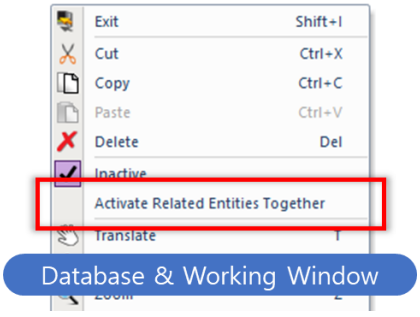
Description

It is now possible to switch the Active/Inactive state of the Subsystem in the same way as the Body or Group. At this time, the objects (Joint, Force, Contact) connected to the Subsystem are also automatically made Active/Inactive. A Subsystem that is Inactive is not reflected in the calculation when simulating.

- Active/Inactive of Subsystem: The Active/Inactive status can be switched in the Subsystem Properties dialog box, database pop-up menu, and Subsystem pop-up menu in the Working Window. The Inactive objects are changed to the color specified in [Home tab]→[Setting group]→[Display]→[Geometry tab]→[Color of an Inactivated Entity], and the icon of inactive objects is also changed in the database.

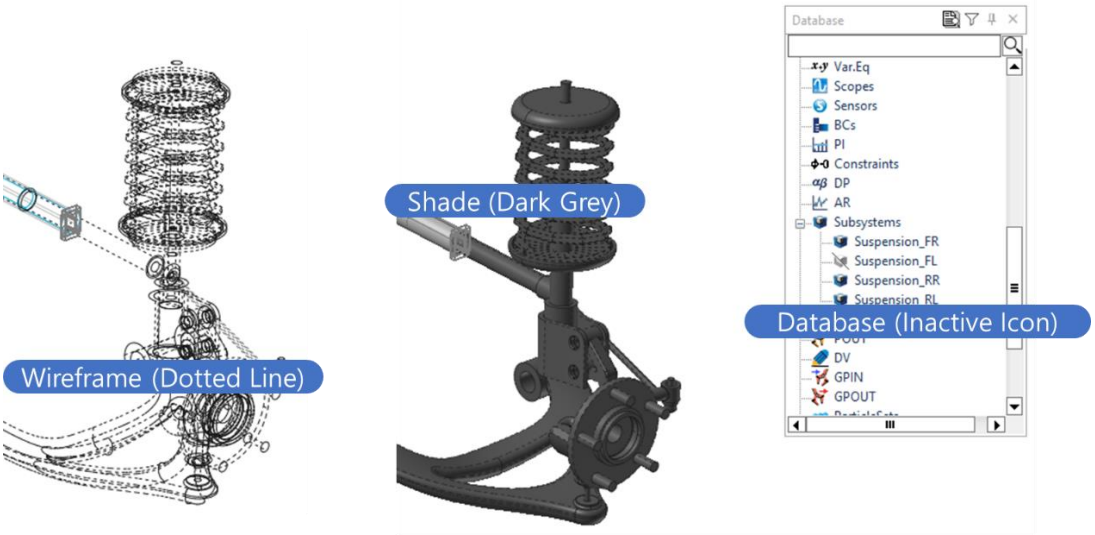


- Activate Related Entities Together: This function is available from the right-click menu for a Subsystem in an Inactive state. If this menu is selected, the Subsystem is converted to the Active state, and at the same time, the objects connected to the Subsystem are also converted to the Active state (if the users switch to the Active state through the Inactive menu from the pop-up menu, the SubEntity changes to the Active state. However, the objects connected to the Subsystem do not change to the



Active state).

- Graphic Changes in Inactive State: Inactive objects are changed to the color specified in [Home tab]→[Setting group]→[Display]→[Geometry tab]→[Color of an Inactivated Entity], and the wireframe is changed to a dotted line. The icons of Inactive objects are also changed in the database.



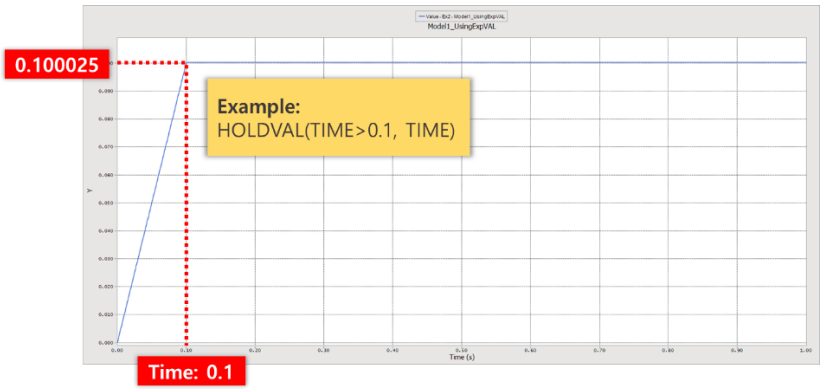
HOLDVAL() Function to Keep the Return Value When the Condition Is Satisfied

Product	Professional
New/Improved	Improved
Location in User Interface	SubEntity tab → Expression group → Expression icon
Location in Manual	4. Subentity → 4.7. Expression → 4.7.1. Available Functions → 4.7.1.7. Equation

Description

The new HOLDVAL() function keeps the return value when a user-specified condition is satisfied. Through HOLDVAL(), it is now possible to obtain the value for the initial time point when the condition specified by the user becomes a non-zero value.

- HOLDVAL(Condition, Equation)
  - Condition: A user-specified condition that causes the equation value to be maintained once the condition becomes nonzero.
  - Equation: When the user-specified condition is 0, the return value of the corresponding Equation is updated real time. The value of the Equation at the initial moment when the specified condition becomes a non-zero is maintained.
  - Both the general Expression functions and the Simulation Variables can be used to define Conditions or Equations.
- Example
  - HOLDVAL(TIME>0.1, TIME): As in 0.100025, the initial time of the moment satisfying TIME > 0.1 is maintained as the return value.



  - HOLDVAL(DM(Marker1, Marker2) >= 100, TIME): Keeps the initial time of the moment

when the distance between two markers exceeds 100 as the return value.

- HOLDVAL(DM(Marker1, Marker2) >= 100, DX(Marker3, Marker4)): The X-axis displacement between marker3 and marker4 at the moment when the displacement between marker1 and marker2 exceeds 100 is maintained as the return value.

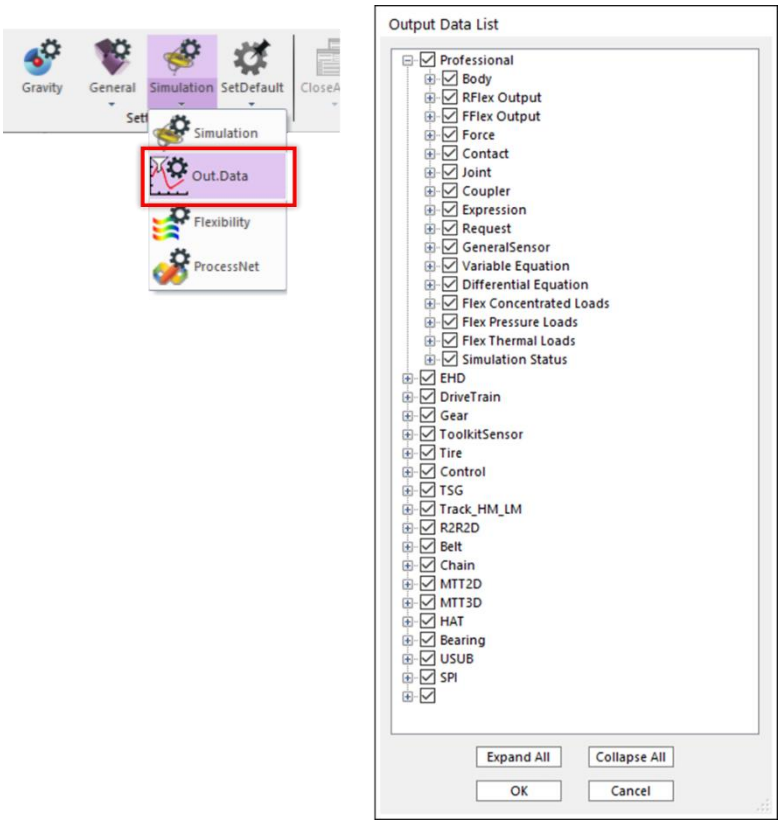
User-Defined RPLT Data

Product	Professional
New/Improved	New
Location in User Interface	Home tab → Setting group → Out.Data icon Analysis tab → Output group → Out.Entity
Location in Manual	3. Home → 3.8. Output Data List 5. Analysis → 5.12. Output

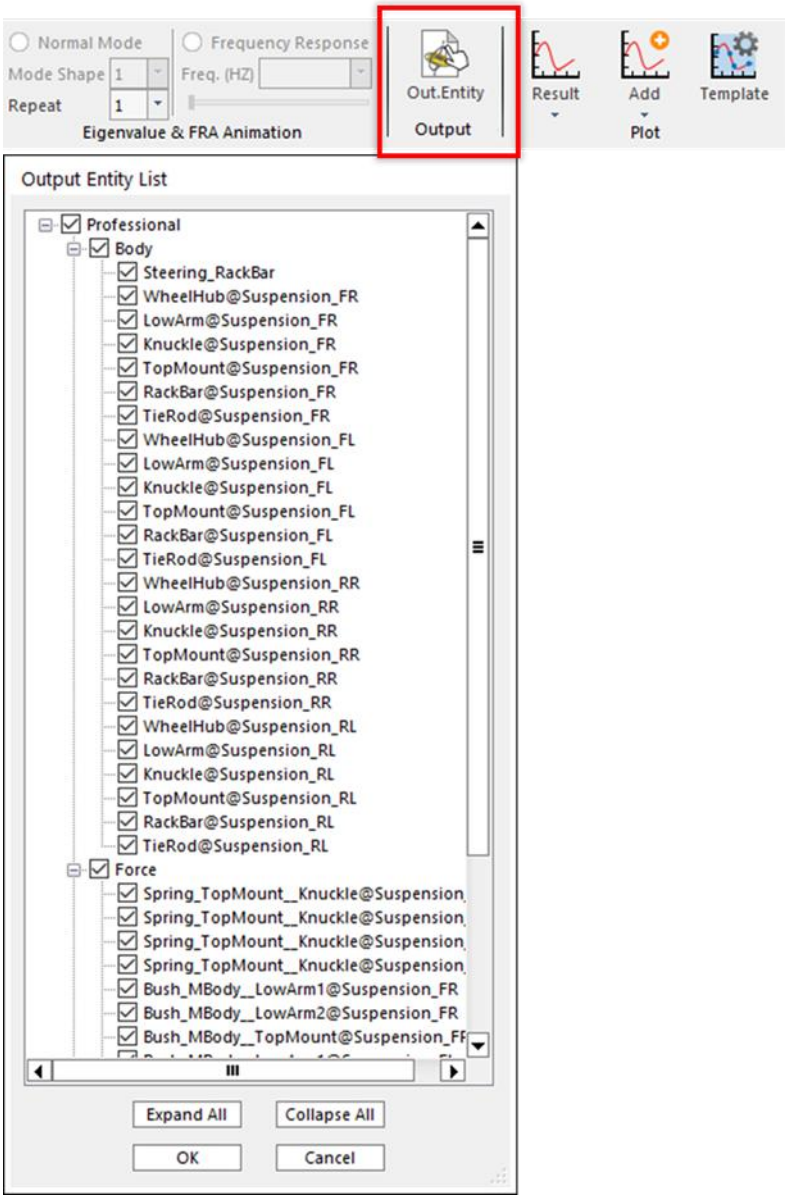
Description

It is now possible to directly specify the data to be saved in the RPLT file, which is a result file generated after the RecurDyn analysis. This feature allows the size of the RPLT file to be significantly reduced by storing only the desired results for models with large result data. The data to be stored in the RPLT file can be specified through the following two settings.

- Output Data: The data to be saved in the RPLT file can be added or excluded from the Output Data List dialog box. The items unchecked in the list are not saved in the RPLT file. The size of the RPLT file is reduced, however, the unchecked items cannot be checked with a plot unless the simulation is reperformed after selecting the relevant items.



- Output Entity: Only the objects belonging to the current model are displayed in the Output Entity List dialog box. The results of unchecked objects in the list are not saved in the RPLT file. The size of the RPLT file is reduced, however, the unchecked items cannot be checked with a plot unless the simulation is reperformed after selecting the relevant items.

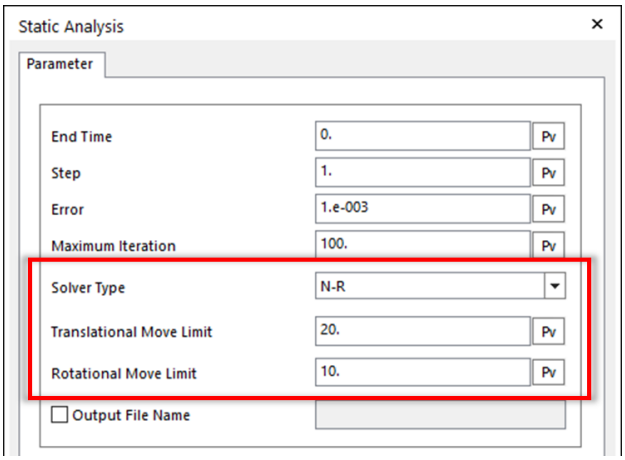


Static Solver Improvements

Product	Professional
New/Improved	Improved
Location in User Interface	Analysis tab → Simulation Type group → Static icon
Location in Manual	5. Analysis → 5.2. Static Analysis

Description

RecurDyn's Static solver has been significantly improved. After more than two years of development, a new N-R (Newton-Raphson) algorithm has been developed that improves both the convergence and the accuracy of the static analysis of a model composed of rigid bodies and RFlex bodies. In addition, it is now possible to perform a static analysis of an MFBD model, including the contact between FFlex bodies and both rigid and RFlex bodies. This allows the users to quickly understand the static equilibrium of the MFBD model. The default of the Static solver has also been changed from Robust N-R to N-R.



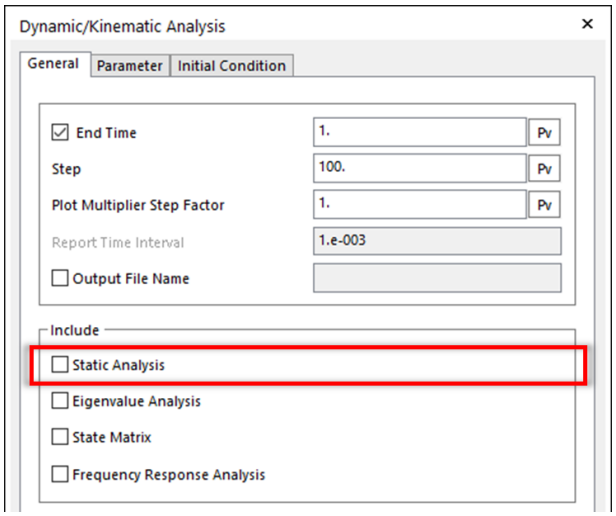
- The two types of the Static solvers, which are N-R and Robust N-R, are supported. The improved Static solver in the new version of RecurDyn is N-R type.
  - It is recommended to use the N-R type and perform the static analysis by changing the model that used the Robust N-R type in the previous version to the N-R type.
  - For reference, only the Robust N-R type can be used for the models using Chain, Belt, TrackLM, and Track HM toolkits.
- Translational Move Limit, Rotational Move Limit (Degree)
  - These parameter specifies the maximum value of the translational/rotational changes in each iteration. A smaller value results in a more precise convergence, but the simulation time may take longer.

- After estimating the overall translational/rotational amount of the bodies in the model, it is recommended to set the limit between 1/10 to 1/100 of the value.

Benefits

It is now possible to check the static equilibrium state of the MBD model of an assembly of rigid bodies as well as the MFBD model of an assembly of flexible bodies. In particular, since the static equilibrium state of the model, including the contact of the FFlex bodies, can also be obtained, the consistency of an MFBD model can be checked more quickly.

In addition, when selecting the Include Static Analysis option, which can be used for dynamic analysis, the improved Static solver can be used. Therefore, even in the MFBD model, it is now possible to perform the MFBD analysis in the static equilibrium by using the Include Static Analysis option, enabling it to quickly obtain stable results.



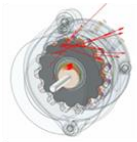
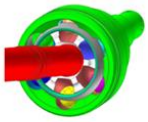
Solver Improvements

Product	Professional
New/Improved	Improved
Location in User Interface	-
Location in Manual	-

Description

The latest compilers and libraries have been applied to the solver in RecurDyn 2023. The Sparse Linear Solver has been improved and the default solver options have been optimized.

In addition, the Geo Surface Contact's support for symmetric multiprocessing (SMP) improves the contact algorithm performance by about 50%. Simulation time can be reduced by up to 40-50% for models with heavy use of Geo Surface Contacts.

No. of GeoSurface Contact Definition	3	33	1,345
Analysis time improvement rate when SMP is applied (Compared to the analysis time without SMP applied)	51%	54%	39%

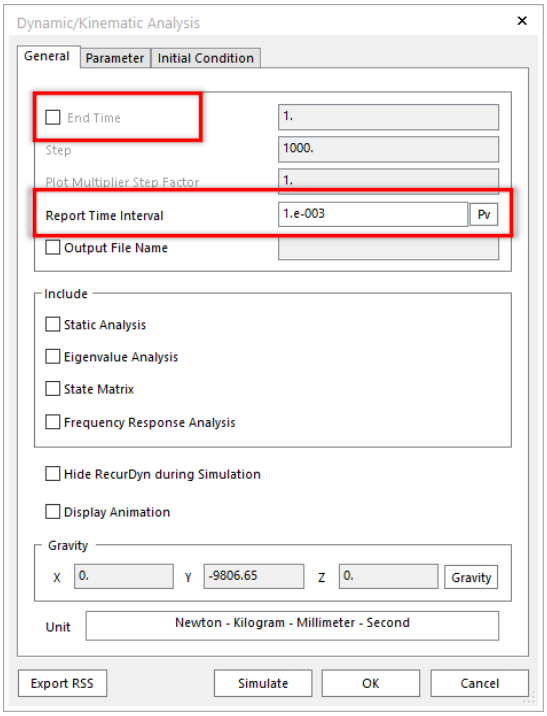
Endless Simulation

Product	Professional
New/Improved	Improved
Location in User Interface	Analysis tab → Simulation Type group → Dyn/Kin icon
Location in Manual	5. Analysis → 5.1. Dynamic/Kinematic Analysis → 5.1.1. Property

Description

When performing a simulation using [Dynamic/Kinematic Analysis] in RecurDyn, it is now possible to determine whether or not to specify the Simulation End Time. This can be used in conjunction with the Stop Condition so that the simulation doesn't stop until the stop condition is satisfied.

- End Time (On): Performs simulations by specifying the End Time, Step, and Plot Multiplier Step Factor (same as before).
- End Time (Off): Since End Time is not specified, the simulation continues until the user clicks the Stop button. For reference, the End Time, Step, and Plot Multiplier Step Factor are inactive.
- Report Time Interval: If the End Time is not specified, the result values saved in Animation Step or Plot (RPLT) follow the time interval set in Report Time Interval.



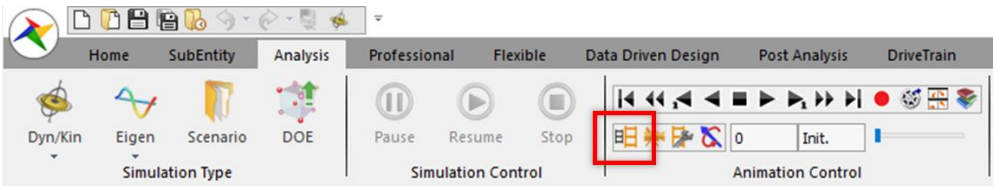
Animation Scaling Enhancements

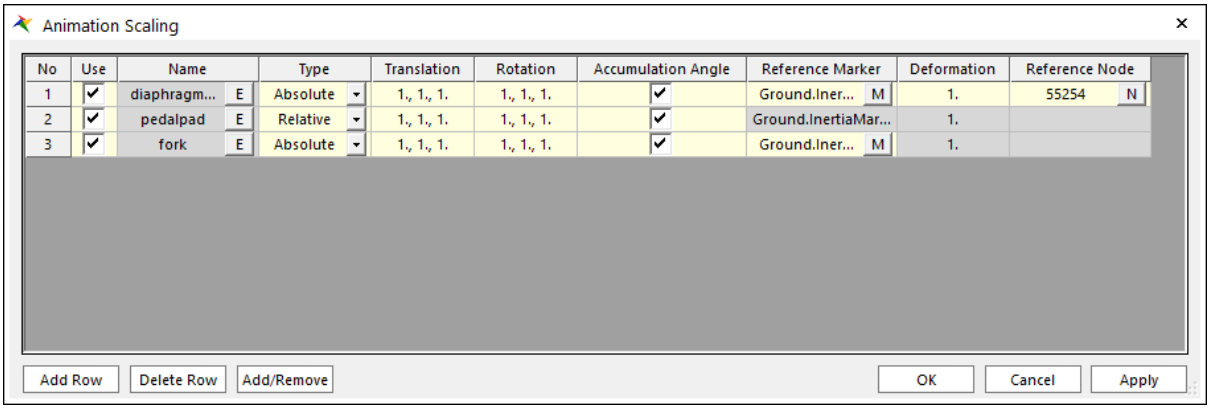
Product	Professional
New/Improved	Improved
Location in User Interface	Analysis tab → Animation Control group → Animation Scaling icon
Location in Manual	5. Analysis → 5.10. Animation Control → 5.10.5. Animation Scaling

Description

The Animation Scaling functions have been significantly improved in RecurDyn 2023. It is now possible to apply Animation Scaling to the deformation of a FFlex body. When playing an animation, the Deformation and the Translation/Rotation Motion with Animation Scaling applied can be checked at the same time.

The method for applying Animation Scaling has been improved. In the previous version of RecurDyn, the user was required to set whether or not to apply Animation Scaling and related parameters in the Properties dialog box of the Body. However, in RecurDyn 2023, the user can apply Animation Scaling to specific bodies and enter the related parameters and references in the Animation Scaling dialog box of the Analysis tab, as shown in the figures. Accordingly, the Animation Scaling setting button has been removed from the individual Body Properties dialog box.





- Use (checkbox): Activates Animation Scaling for the specified body.
- Name: Users can select the Body to which the Animation Scaling will be applied from the Entity list and choose FFlex/RFlex/Rigid Body or Beam Group (Force).
- Type: Either Absolute or Relative can be selected.

- Translation/Rotation: The scaling factors for translation and rotation are entered.
- Accumulation Angle: Users can choose whether to use the Accumulation Angle option or not. In general, it is recommended to use Accumulation Angle. However, it is not recommended to use this option if a body reciprocates between ⟦-θ⟧_1 ~ θ_2 with the rotational motion.
- Deformation: The scale factors for the deformation of the FFlex body and RFlex body are entered.
- Reference Marker/Node: When the Type is Absolute, users can directly specify the Reference Marker or Reference Node.

Benefits

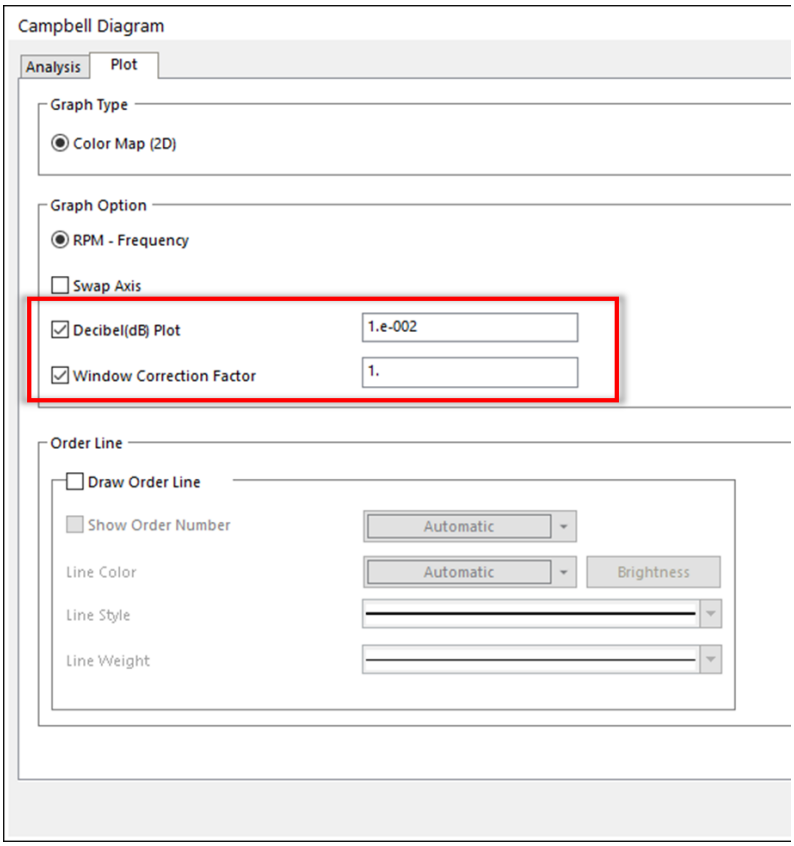
In RecurDyn 2023, the improved Animation Scaling function allows users to easily observe the animation by simultaneously scaling both the displacement and deformation of relatively small parts in mechanical system analysis.

Campbell Diagram Improvements

Product	Professional
New/Improved	Improved
Location in User Interface	Plot → Tool tab → Analysis group → Campbell(3D) icon
Location in Manual	7. Plot → 7.2. Tool → 7.2.1. Analysis → 7.2.1.6. Campbell Diagrams

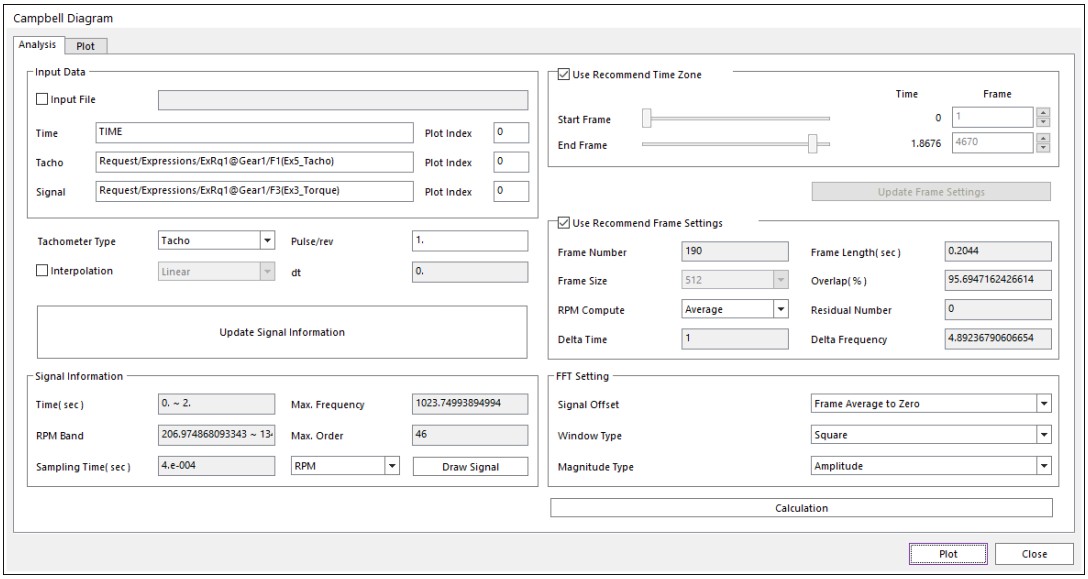
Description

- It is now possible to display the magnitude in decibels (dB) in Campbell diagrams.
  - The dB conversion formula is 20 log10 (M/M0), where M0 = 1.0e-5 [m/s].
- When drawing the Campbell diagrams, the Window Correction Factor can be applied.

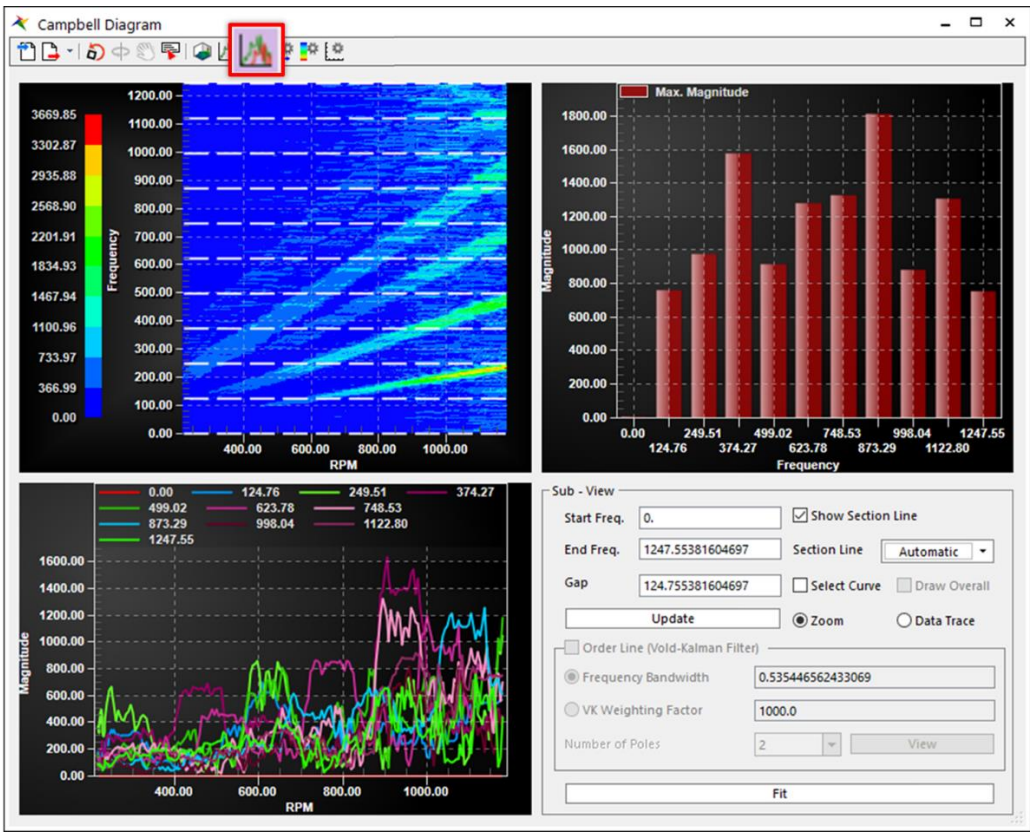


  - The dB display and the Window Correction Factor are also supported in RecurDyn Post.

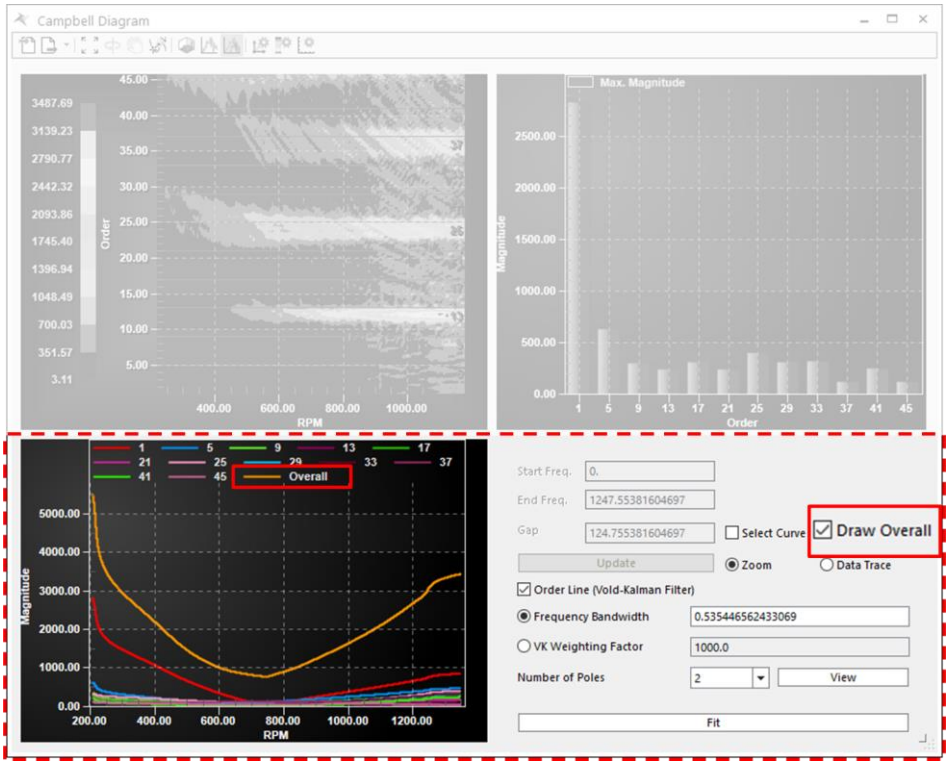
- The design of the Campbell diagram dialog box in the Plot window has been improved.



- Slice View: In RecurDyn V9R5, the users could check the data of the specified RPM or Frequency using the Section View function. RecurDyn 2023 provides the Slice View function that allows the users to check the graphs for the multiple sections and the maximum value of each graph at a glance.



- Overall Curve: In the Slice View of the Campbell diagram for RPM-Order, it is now possible to draw an Overall Curve that sums up all the graphs for each frequency.

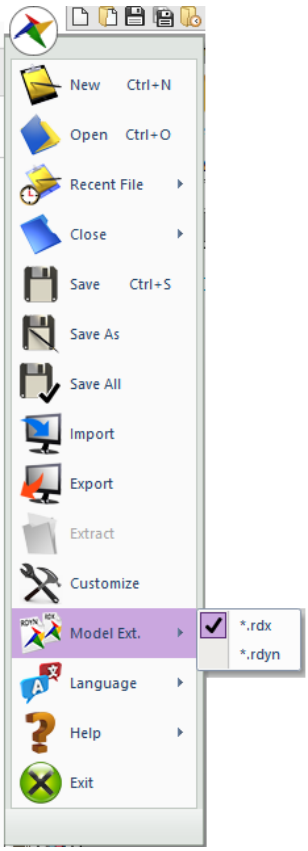


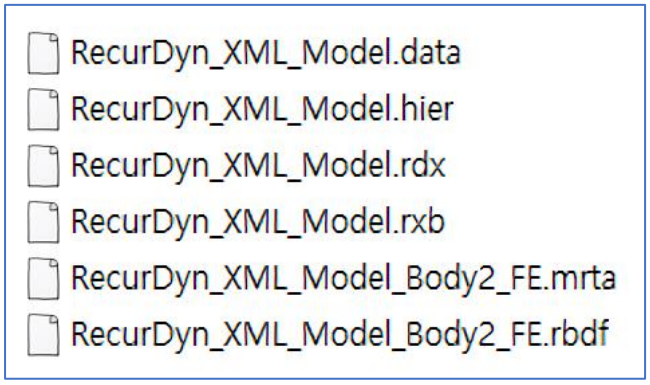
Format Change of RecurDyn Model File

Product	Professional
New/Improved	Improved
Location in User Interface	-
Location in Manual	2. User Interface → 2.2. RecurDyn Graphic User Interface → 2.2.2. File Menu

Description

It is now possible to select either rdyn or rdx as the default file format when saving it using the Model Ext. Option, as shown in the figure. Since the rdx file is based on the text format (XML format), the information is divided and saved in several files depending on the model. For detailed information about each file, please refer to the manual.





MFBD

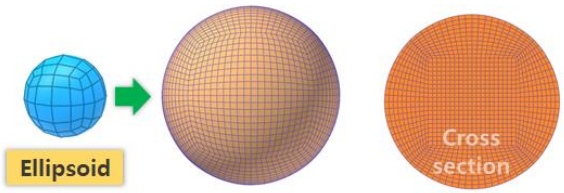
Mesher Enhancements

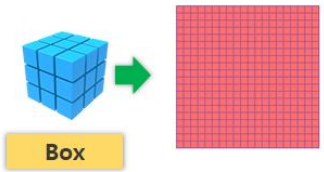
Product	FFlex
New/Improved	New
Location in User Interface	Mesher tab → Mesher group → Ellipsoid/Box/Cone icon
Location in Manual	12. Mesher → 12.3. Meshing Functions in Mesh Mode → 12.3.7. Primitive Mesh

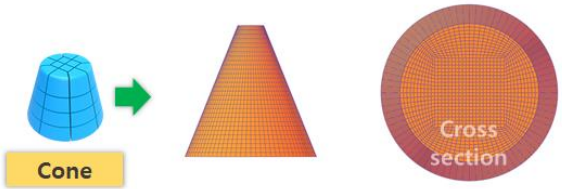
Description

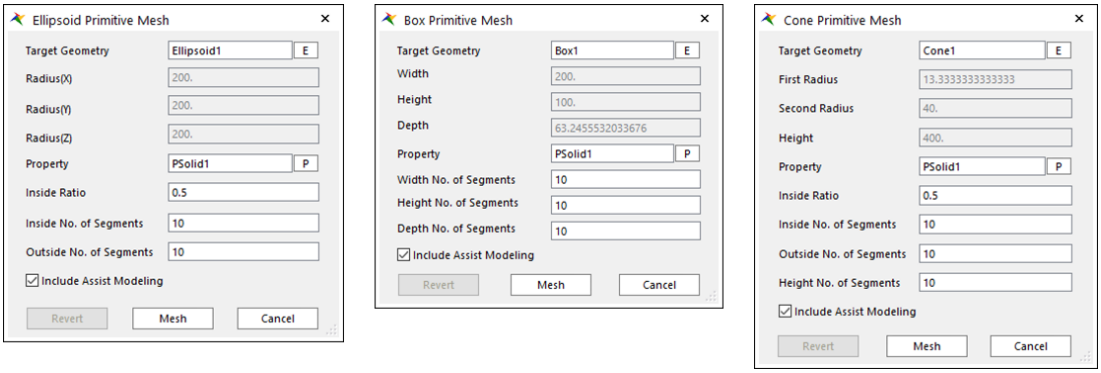
Several useful features have been developed for the Mesher. A Primitive Auto Mesh for the Sphere, Box, and Cone geometry has been added, and a Beam Mesh is automatically updated by maintaining the connection between the Target Geometry and the Mesh when the shape of the Target Geometry is changed. A Parametric Value can also be used for a Manual Mesh (Extrude, Spin, Sweep).

- Primitive Auto Mesh: The Primitive Mesh function creates an optimal mesh for primitive shapes such as a Sphere, Box, or Cone. It is now possible to specify the Sphere, Box, and Cone Geometry created by RecurDyn and create high-quality meshes that fit the shapes.





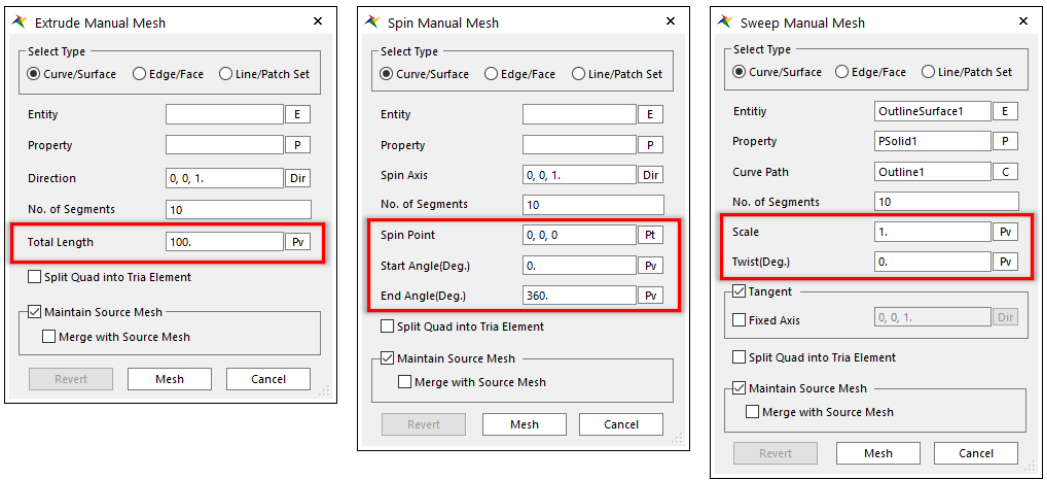




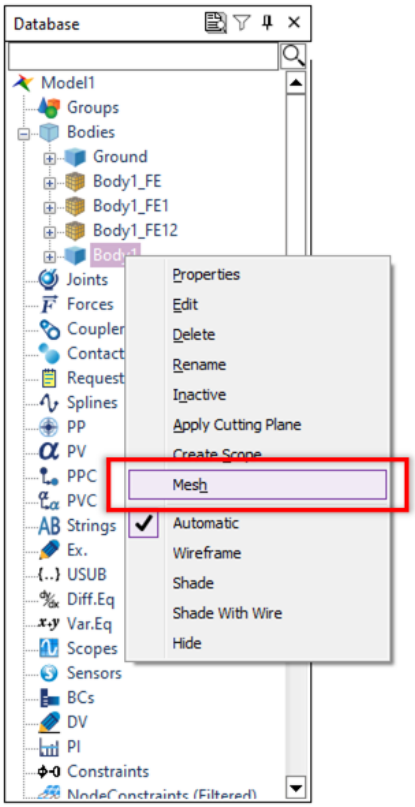
- Geometry Relation: When the Target Geometry of the Mesh is modified, the Mesh is automatically updated accordingly.

  - Beam: After creating a Beam Mesh by specifying a RecurDyn Outline, Spline, Circle, Arc, or Helix Curve as the target geometry, and modifying the corresponding Curve Geometry, the Beam Mesh is automatically updated.

  - Manual Mesh (Extrude, Spin, Sweep): Parametric Values can be used to define the main Mesh Parameters in Extrude, Spin, Sweep, or Manual Mesh. If the Parametric Value is modified, the Mesh is automatically updated.



- Mesh Command Added in the Database Pop-up Menu: The Mesh option has been added to the right-click menu of the body in the database.



Benefits

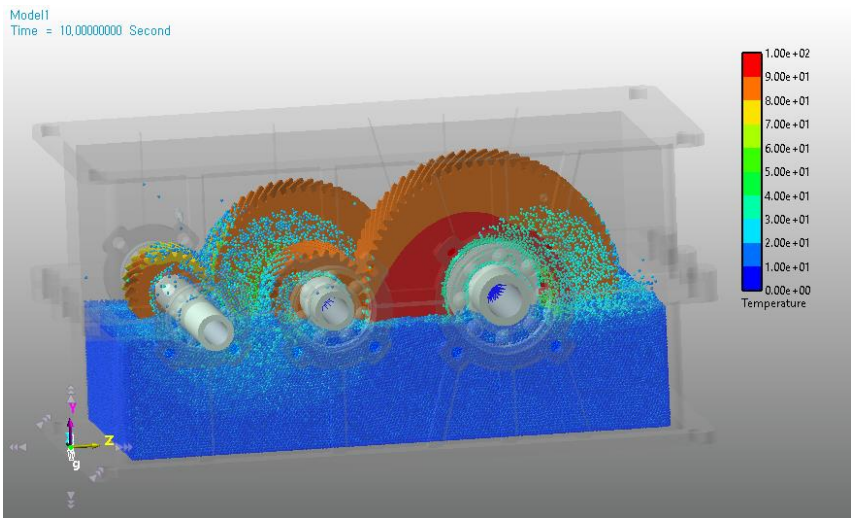
It is now possible to create high-quality Meshes for a Sphere, Box, or Cone using the Primitive Auto Mesh function. When the shape of a curve is changed, the associated Beam Mesh is automatically updated, saving Meshing time.

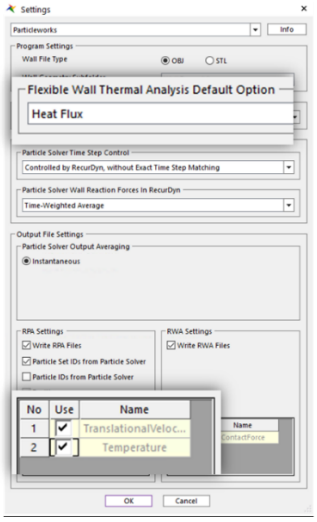
Two-way Thermal Fluid Co-simulation between FFlex Thermal and Particleworks

Product	External SPI
New/Improved	Improved
Location in User Interface	External SPI tab → Particleworks group → Settings icon
Location in Manual	23. SPI → 23.1. External SPI → 23.1.3. Functions for External SPI → 23.1.3.1. Pre-Process → 23.1.3.1.3. Settings

Description

When using Particleworks version 7.2 or later, it is now possible to use a bidirectional heat transfer function between the RecurDyn FFlex (flexible body) and the Particleworks MPS particles (fluid particles). The Heat Transfer Coefficient (HTC) calculated by Particleworks and the temperature information of the fluid are exchanged with the temperature information of the flexible body of RecurDyn according to a set time interval. Each temperature condition is used as a boundary condition for the heat transfer analysis of the fluid and solid. The two software send and receive information in the two-way communication through a dedicated interface. This feature predicts the cooling and heating of the body by the fluid and the corresponding expansion and contraction of the body structure.





Benefits

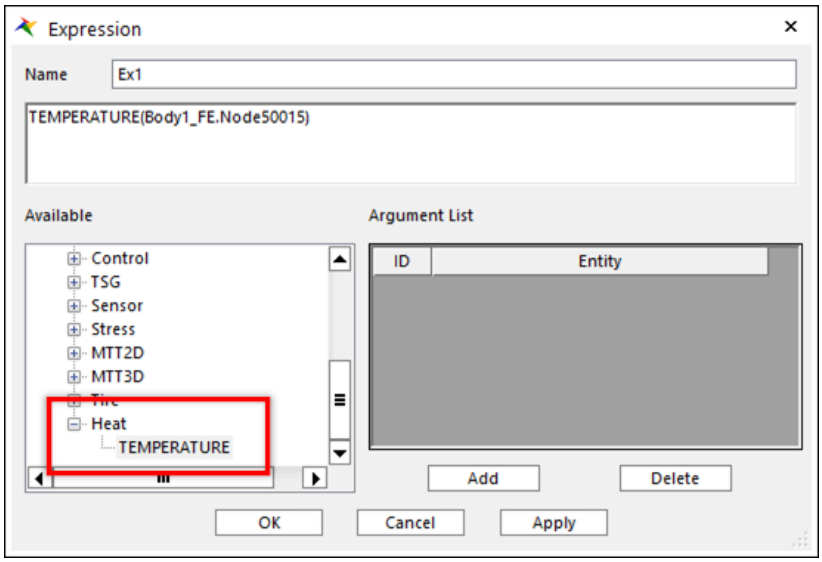
The heat transfer of a moving body in close contact with the fluid and its thermal analysis can be predicted through simulation. In particular, it is now possible to visually predict and understand how a body in a high-temperature state is cooled by the surrounding fluid.

Temperature() Function to Check a Node's Temperature

Product	FFlex
New/Improved	Improved
Location in User Interface	SubEntity tab → Expression group → Expression icon
Location in Manual	4. Subentity → 4.7. Expression → 4.7.1. Available Functions → 4.7.1.17. Heat

Description

When performing an MFBD analysis, including thermal analysis, using the Heat Flux, Convection, and Heat Generation capabilities of FFlex, this newly-added Expression function provides the temperature of the user-specified Node. The Temperature() function uses the Node of the FFlex Body to which thermal analysis is applied as an argument. It is now possible to check the temperature changes of the specified node in real-time when performing the MFBD simulation.

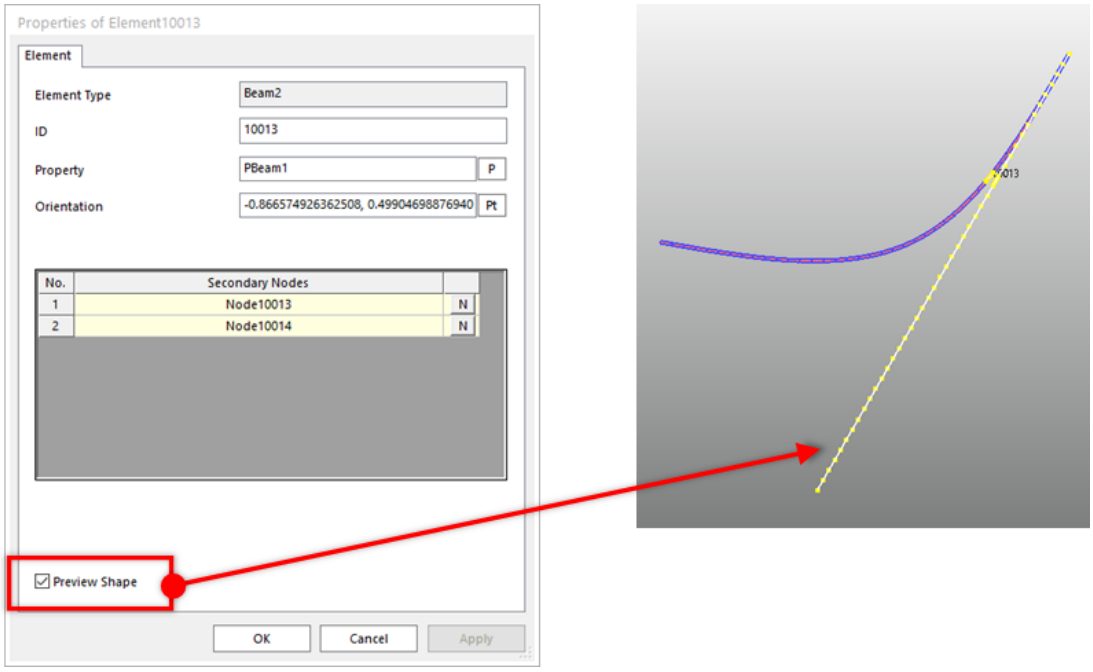


Beam Preview

Product	FFlex
New/Improved	Improved
Location in User Interface	Beam Element Properties → Preview Shape option
Location in Manual	9. FFlex → 9.7. Edit Functions for FFlex body → 9.7.3. Element Modification

Description

For a Beam which is Pre-Stressed, a newly added Preview function allows the user to check the Beam Shape before the Pre-Stress is applied in the Properties dialog box of the Beam Element.



Benefits

It is now possible to check the difference between the original beam shape and the deformed beam shape due to Pre-Stress. This helps the user understand and estimate the magnitude and direction of the reaction force in the beam at the beginning of the analysis.

Control

Integration of Co-Simulation Functions

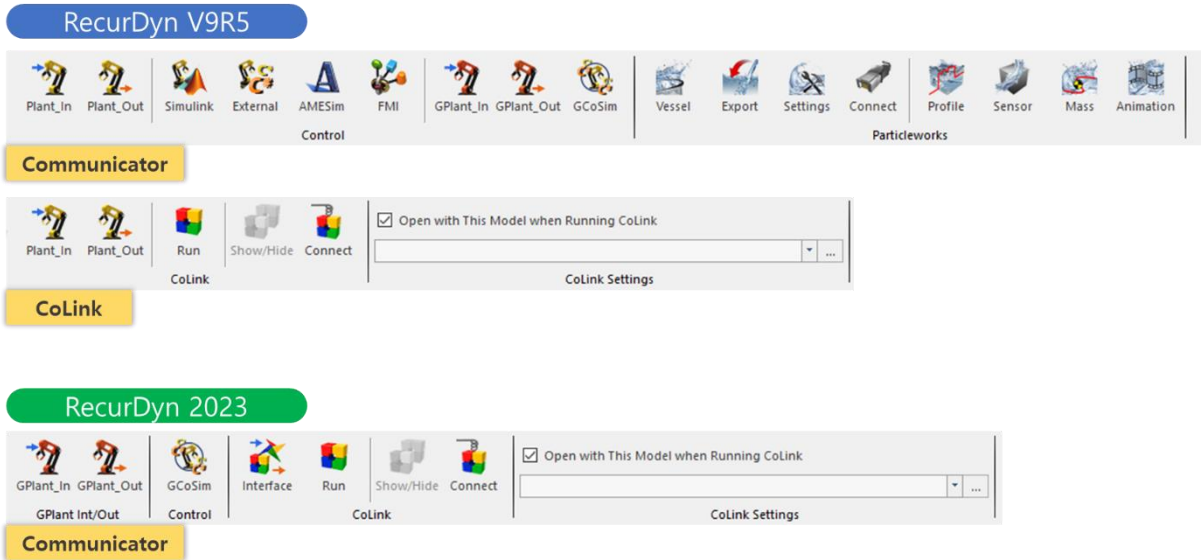
Product	Control
New/Improved	Improved
Location in User Interface	-
Location in Manual	-

Description

The Co-Simulation related functions in the existing Communicator tab are integrated into General CoSim in RecurDyn 2023. CoSim Simulink, CoSim External, AMESim Interface, and FMI in the existing Communicator tab are integrated into General CoSim, and Plant Input/Output is integrated into GPlant Input/Output.

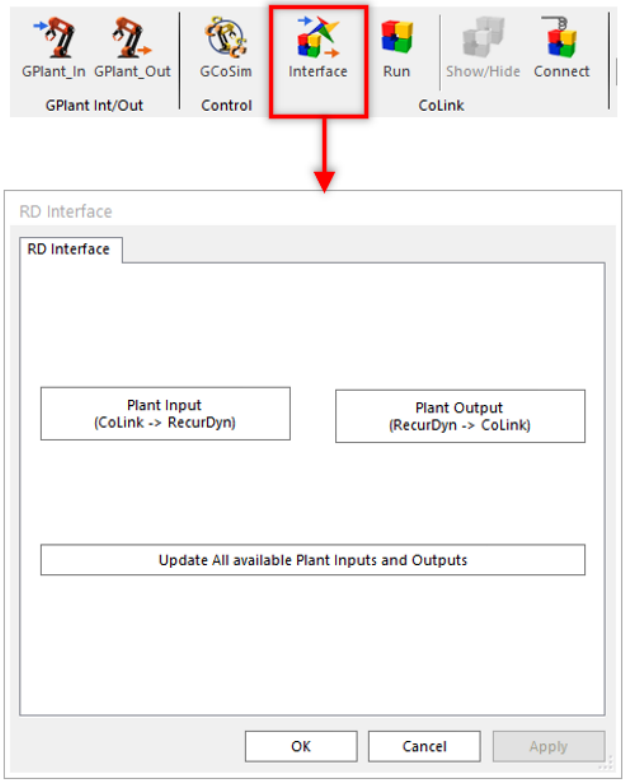
In addition, the CoLink-related functions in the existing CoLink tab have been moved to the Communicator tab (CoLink group, CoLink Settings group). The location of the CoLink-related functions has changed, but its functions remain the same.

The Plant_In and Plant_Out defined in the existing RecurDyn model are automatically converted to GPlant_In and GPlant_Out when opening the model in RecurDyn 2023.



- Changes
  - CoSim Simulink → General CoSim's Simulink Type
  - CoSim External → General CoSim's RDExternal Type
  - AMESim Interface → General CoSim's FMI Type
  - FMI → General CoSim's FMI Type
  - CoLink related features → Moved into the Communicator tab
  - Plant_In → GPlant_In (State Matrix supported)
  - Plant_Out → GPlant_Out (State Matrix supported)

In addition, the newly added Interface function for CoLink enables users to specify GPlant_In and GPlant_Out used in CoLink when CoLink or other control software is co-simulated with RecurDyn.



Toolkits

New Toolkit - Data Driven Design

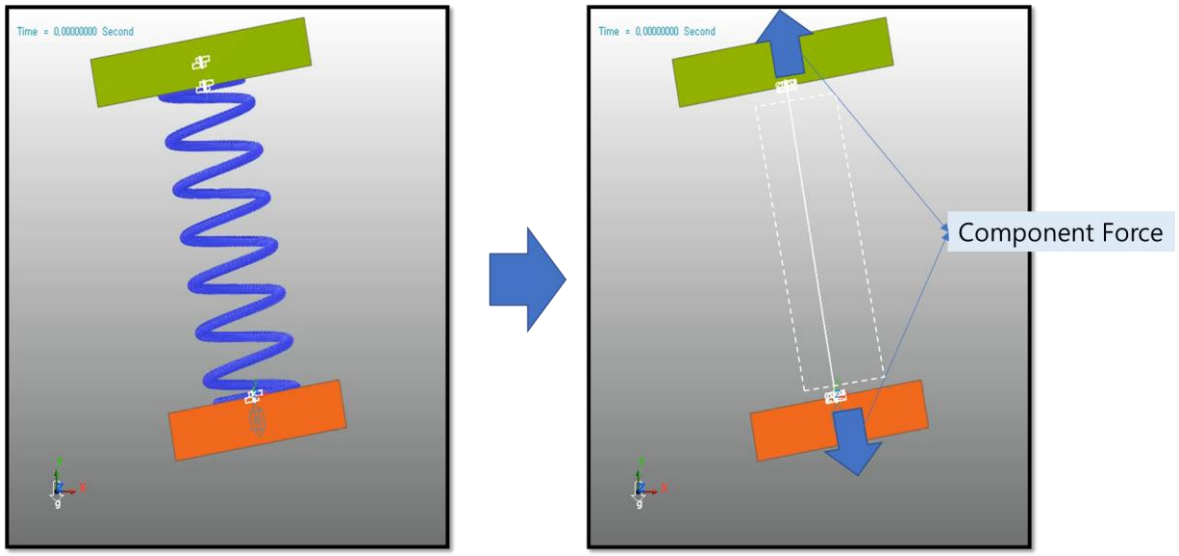
Product	Data Driven Design
New/Improved	New
Location in User Interface	Data Driven Design tab
Location in Manual	13. Data Driven Design

Description

The newly added RecurDyn/Data-Driven Design in RecurDyn 2023 is a toolkit that can apply a meta-model created from Big Data, including a massive amount of simulation data, experimental data, and empirical data, to the multibody dynamic analysis. This significantly speeds up the dynamic analysis by replacing the elements, such as flexible bodies that require much analysis time, with meta-models.

In RecurDyn 2023, a Component Meta-Model (CMM) from one specified flexible body can be created and used for dynamic simulation. The various displacements, relative to the Interface Marker of the specified flexible body, are used to create the meta-model. A DOE simulation is performed using the static solver and captures the flexible body's behavior for each displacement case. The DOE analysis enables obtaining the reaction force generated at the location of the Interface Marker for various cases and a Component Meta-Model (CMM) can be created from the output data.

Once a meta-model is created, RecurDyn performs a dynamic analysis of the entire system. At this time, the simulation is performed using the meta-model instead of the specified FFlex Body. The many equations of the flexible body are replaced by the equations of a component force, resulting in a fast dynamic analysis.



Benefits

By replacing the flexible body with the meta-model to perform a dynamic system simulation, the speed of the dynamic analysis can be greatly improved. This is quite useful when users are more focused on the overall behavior of the system, including the flexible bodies, rather than the behavior of the flexible body itself.

DriveTrain - Ravigneaux Gear

Product	DriveTrain
New/Improved	Improved
Location in User Interface	DriveTrain tab → KISSsoft group → GearTrain icon
Location in Manual	19. DriveTrain → 19.2. Functions for DriveTrain → 19.2.2. KISSsoft → 19.2.2.2. Gear Train

Description

The GearTrain creation method has been improved to enable the creation of a Ravigneaux gear that uses 2 sun gears and 1 carrier. When defining a gear group in RecurDyn V9R5, the base gear had to be specified the same as the action gear in the upper row. However, RecurDyn 2023 lifted this limitation. If the gear is defined in the different gear pairs but is recognized as the same gear, only one gear is created. This enables creating a Ravigneaux gear.

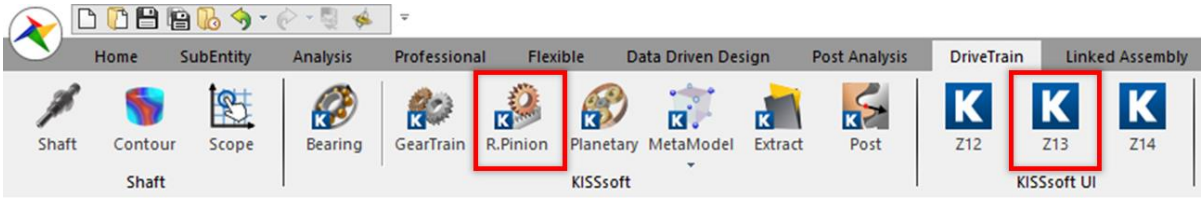
- Given the inputs shown in the table above, a Ravigneaux gear is created as shown on the right.
- Since the gear 4 used in the gear pairs of #3, #7 and #11 has the same size and position, only one gear is created.
- The Gear pair #4 can be defined as a pair of gear 3 and gear 5 after defining the Gear pair #3 which is a pair of gear 3 and gear 4. In other words, the gear 3 can be used as a base gear for both Gear pair #3 and Gear pair #4 (not allowed in RecurDyn V9R5).

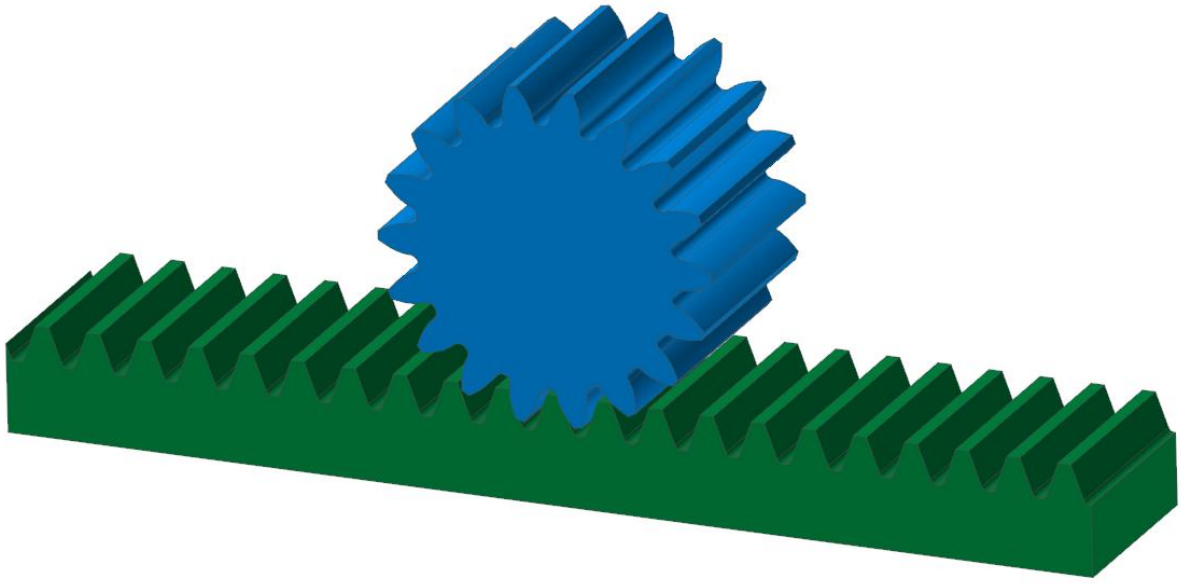
DriveTrain - Rack & Pinion

Product	DriveTrain
New/Improved	New
Location in User Interface	DriveTrain tab → KISSsoft group → R.Pinion icon
Location in Manual	19. DriveTrain → 19.2. Functions for DriveTrain → 19.2.2. KISSsoft → 19.2.2.3. Rack and Pinion

Description

It is now possible to create and simulate a Rack & Pinion. The Rack & Pinion can be created using the R.Pinion icon, and it can also be saved as a KISSsoft Z13 file. The users can import the Z13 file created in KISSsoft. Like other gears, the Rack & Pinion created in this way supports the contact calculation using KISSsoft and the calculation using the gear meta-model.



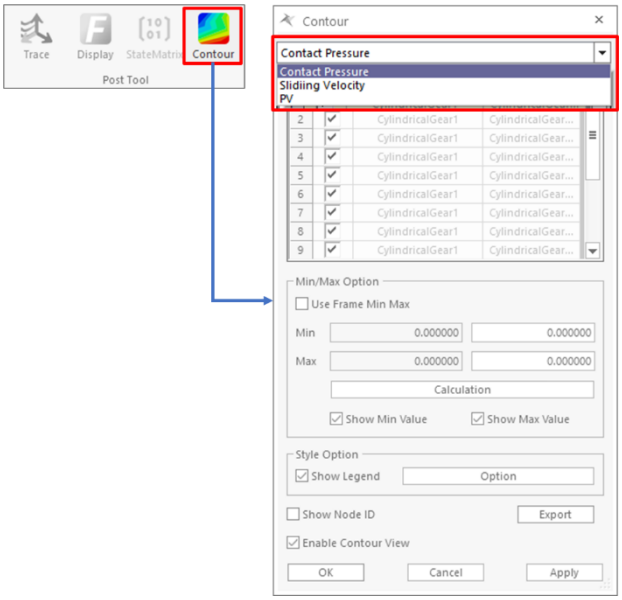


DriveTrain - Other Improvements

Product	DriveTrain
New/Improved	Improved
Location in User Interface	-
Location in Manual	-

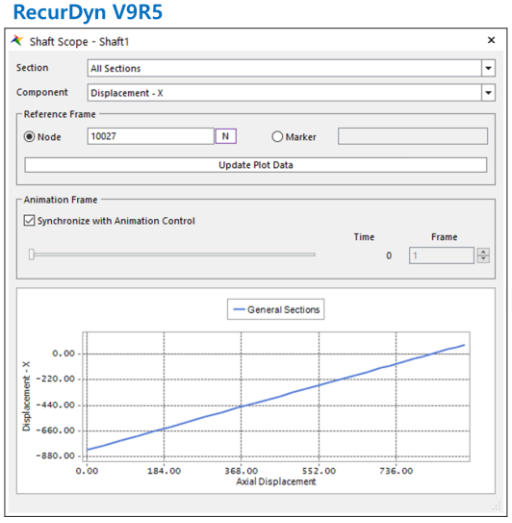
Description

Until RecurDyn V9R5, Contact Pressure, SV (Sliding Velocity), and PV (Contact Pressure X Sliding Velocity) could only be viewed with a graph through KISSsoft Post. In RecurDyn 2023, the results can be checked using a contour, enabling an intuitive understanding of the changes over time.

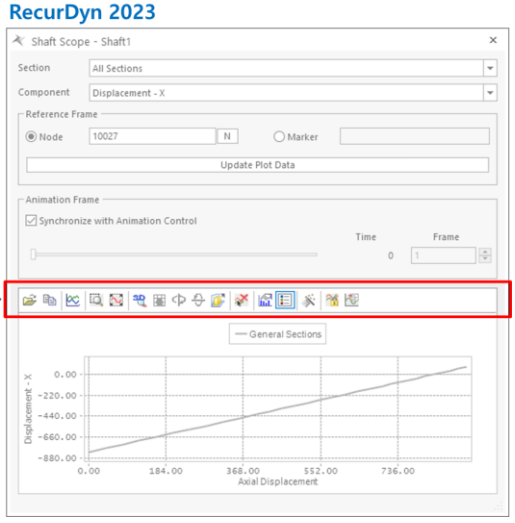


- Since the Plot toolbar is provided as a default setting in the Shaft Scope dialog box, it is now possible to easily perform operations such as enlarging and reducing a graph or copying data.

RecurDyn V9R5



RecurDyn 2023



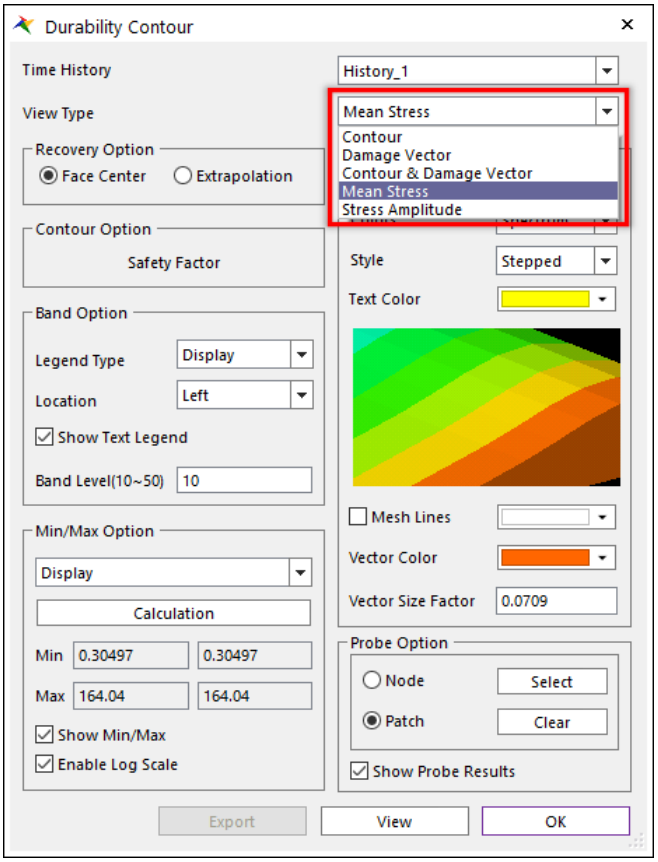
Durability Enhancements

Product	Durability
New/Improved	Improved
Location in User Interface	Post Analysis tab → Durability group → Contour icon
Location in Manual	14. Durability → 14.2. Functions for fatigue results → 14.2.3. Contour

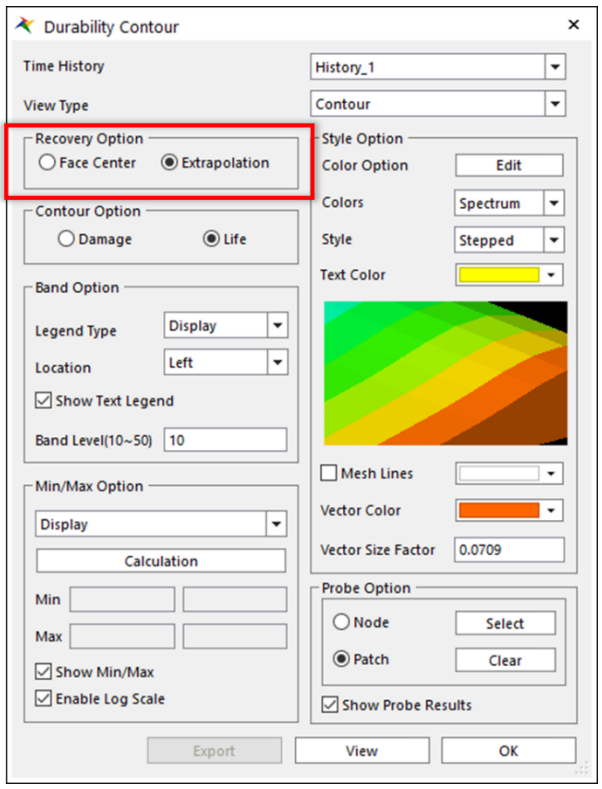
Description

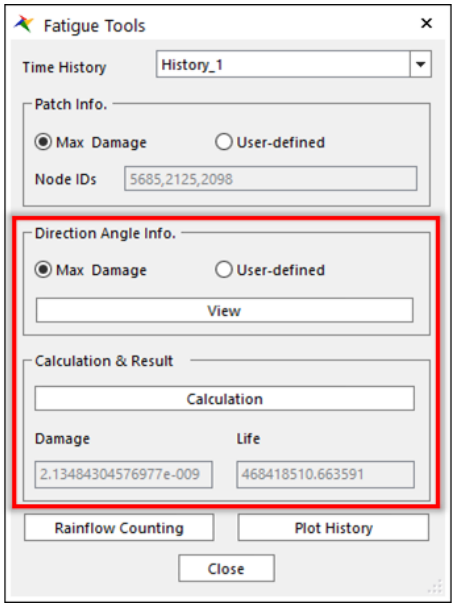
Various features in RecurDyn/Durability have been improved.

- A newly-added View Type in Durability Contour: If the Life Criteria is defined in the Contour Option as a Safety Factor to calculate, the contour results can be checked for the Cycle with the smallest Safety Factor among each Cycle. In addition to Contour, Damage Vector, Contour & Damage Vector, Mean Stress or Stress Amplitude can be selected as the View Type for this contour.
  - Mean Stress: The middle value between the maximum and minimum values for stress
  - Stress Amplitude: The difference between the maximum and minimum values for stress



- Added Recovery Option for Contour: When calculating the fatigue analysis results in the Fatigue Tools dialog box, the value of the Face Center of each element is used. In RecurDyn V9R5, the average value (Extrapolation) was used at each node location in the Contour dialog box. In RecurDyn 2023, it is now possible to choose whether to use the Face Center's value or the averaged value by selecting an option in the Contour dialog box. In this case, the results from the Face Center should be used to check the results consistent with Fatigue Tools.
- Improved Fatigue Tools: It is now possible to check the Direction Angle information of the Patch where Max Damage occurs and the Patch selected by the user. The Damage and Life values of the selected Patch can also be identified through the calculation.
- Warning Message: If the Life Criterion is Manson-Coffin and User-Defined, a warning message appears when the Stress Amplitude goes off the S-N Curve.





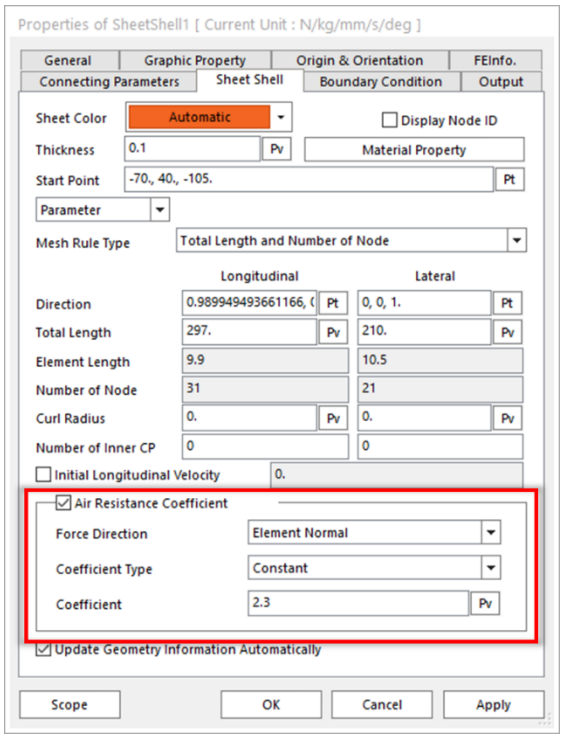
MTT2D/3D - Air Resistance Force Enhancement

Product	MTT2D, MTT3D
New/Improved	Improved
Location in User Interface	MTT3D tab → SheetShell Properties MTT2D tab → SheetGroup Properties
Location in Manual	25. MTT3D → 25.3. Sheet Shell → 25.3.2. Properties 24. MTT2D → 24.3. Sheet Group → 24.3.2. Properties

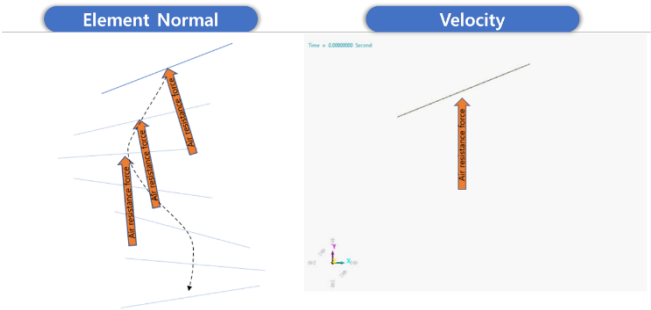
Description

In MTT2D/3D, it is now possible to apply the Air Resistance Force in the vertical direction of the Sheet Element (MTT3D) or the Sheet Body (MTT2D).

In the past, the Air Resistance Force was applied only in the direction opposite to the speed of the Sheet Element or the Sheet Body. In RecurDyn 2023, if the Force Direction is set to Element Normal, the Air Resistance Force is applied in the opposite direction to the normal of the Sheet Element or the Sheet Body.



- Force Direction: The users can select the direction of the Air Resistance Force either Element Normal or Velocity as a drop-down option.



- Element Normal: The Air Resistance Force is applied in the vertical (normal) direction of the Sheet Element or the Sheet Body.

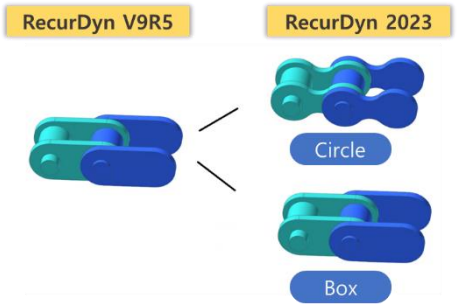
- Velocity: The Air Resistance Force is applied in the direction that is opposite to the velocity of the Sheet Element or the Sheet Body.

Chain - Link Plate Shape Improvements

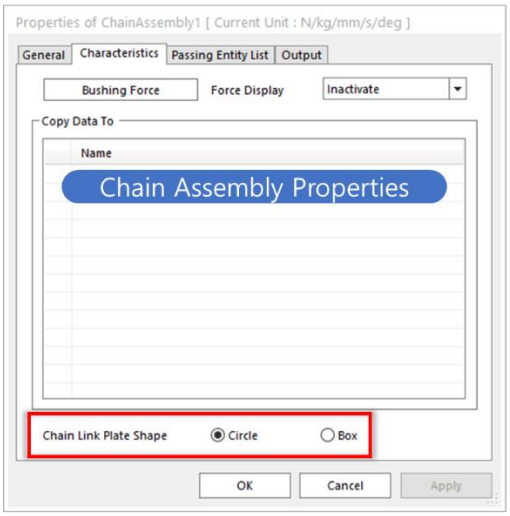
Product	Chain
New/Improved	Improved
Location in User Interface	Chain tab → Link group → Link icon
Location in Manual	30. Chain → 30.2. Geometric Entities → 30.2.5. Roller Link

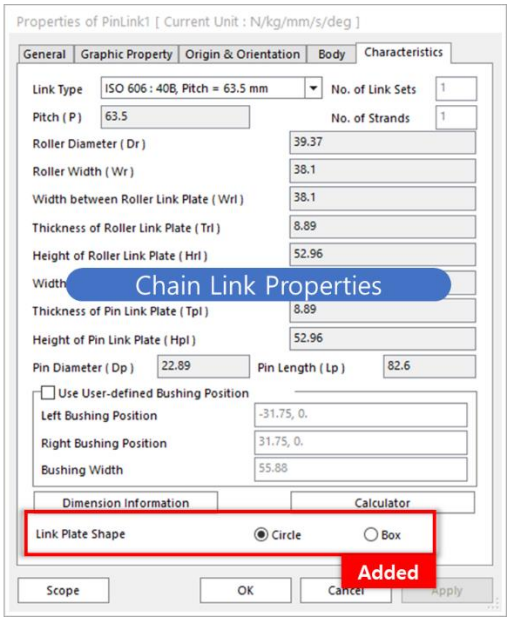
Description

When the Chain Link Plate Shape of Roller Links and Multiplex Links are changed, the shape of the link now updates accordingly. With the change in the Chain Link Plate Shape, the Mass Property information is also updated. The users can now check the contact results more accurately by inspecting the accurate Chain Link Plate shape.



- The location of Chain Link Plate Shape option
  - Chain Assembly Properties
  - Chain Link Properties (Added)





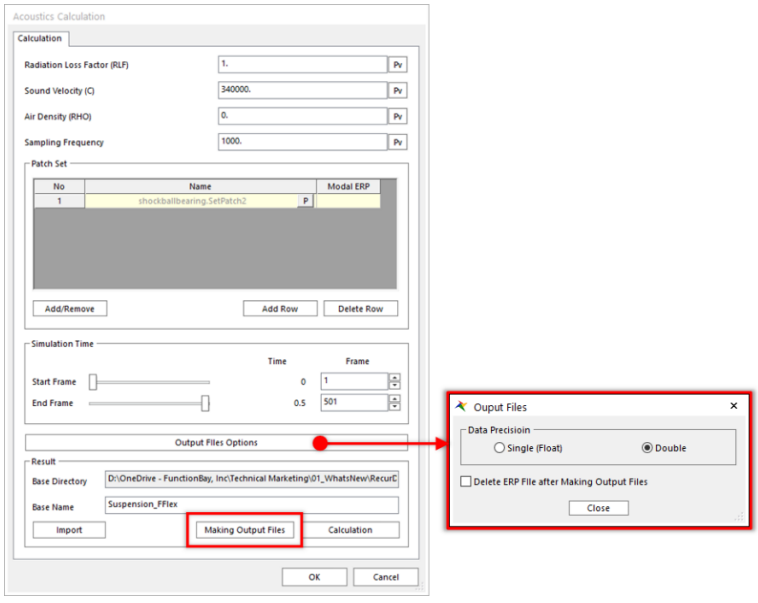
Acoustics - Acoustics Enhancement

Product	Acoustics
New/Improved	Improved
Location in User Interface	Post Analysis tab → Acoustics group → Calculation icon
Location in Manual	15. Acoustics → 15.2. Functions for Acoustics → 15.2.1. Calculation

Description

It is now possible to reduce the file size by optimizing the ERP file, ARD (ERP Contour Data) file, and AMMX (Min/Max ERP Contour Data) file when calculating the ERP (Equivalent Radiated Power) representing the noise characteristics from the MFBD analysis results. It is more effective when selecting a part of the flexible body rather than the entire flexible body as a Patch Set. In addition, ARD files or AMMX files can be selectively created.

In the past, when calculating in the Acoustics toolkit (Calculation button), the ERP and the ACS (Scope Data) file generation and the ARD and the AMMX file generation were performed together. Now, in RecurDyn 2023, the ARD and the AMMX files can be selectively created after the calculation of the ERP file, using the Making Output Files button.



- Output Files Options

  Data Precision: The users can select the data precision to be either Single (Float) or Double. If selecting Single, there is less precision, but the file size is smaller.

  - Delete ERP File after Making Output Files: Deletes the ERP files after generating the ARD and the AMMX files.

- Making Output Files: Creates the ARD and the AMMX files.

Other

Professional

Use of Neutral Terms

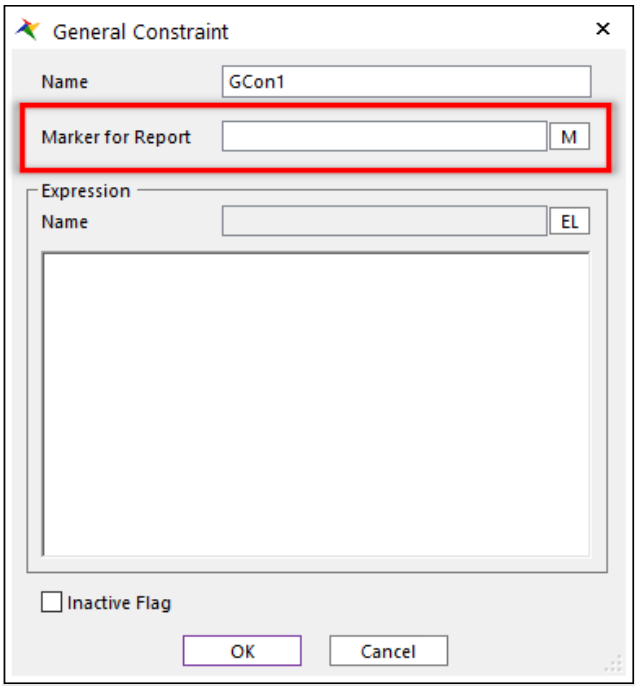
The terms, Master/Slave, which were conventionally used in the IT industry, were deleted from RecurDyn and replaced with Primary/Secondary or Host/Client. For example, Primary/Secondary is used for the body position, and Host/Client is used in General CoSim.

Integration of the Design Study Function

The existing Design Study feature in the Analysis tab has been removed. Instead, it is now integrated into the DOE function in the Analysis tab to provide more extended functionality.

Obtain General Constraint Result Data Related to a specified marker.

The improved UI allows the user to specify a Marker to obtain specific results for a General Constraint. If a marker is specified, the result data is saved in the RPLT file and can be plotted and reviewed in the plot window.



Solver

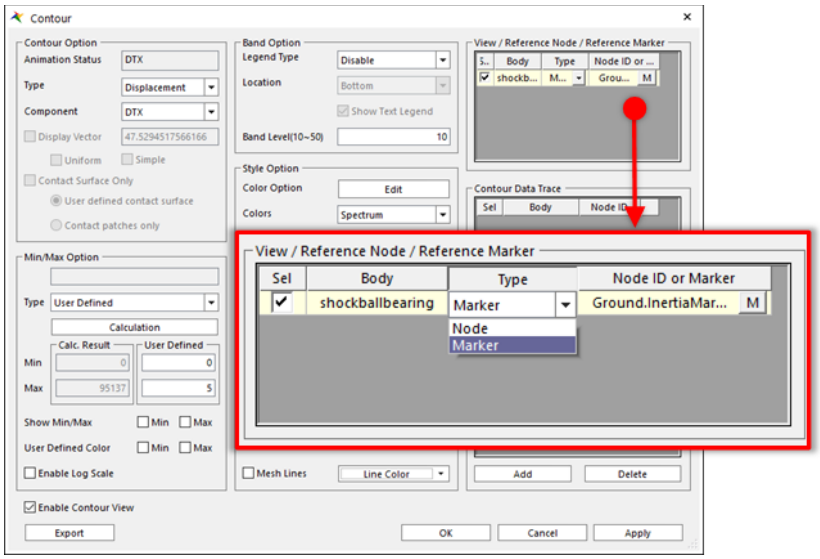
Integration into a single integrator

RecurDyn uses several integrators, such as IMGALPHA, TRKGALPHA, and ADVHYBRID, depending on the model characteristics. RecurDyn 2023 combines the different advantages of the ADVHYBRID integrator into one. This allows the users to simulate all types of models using a single integrator without having to worry about which integrator to choose. Accordingly, the UI for selecting the integrator in the dialog box has been removed.

MFBD

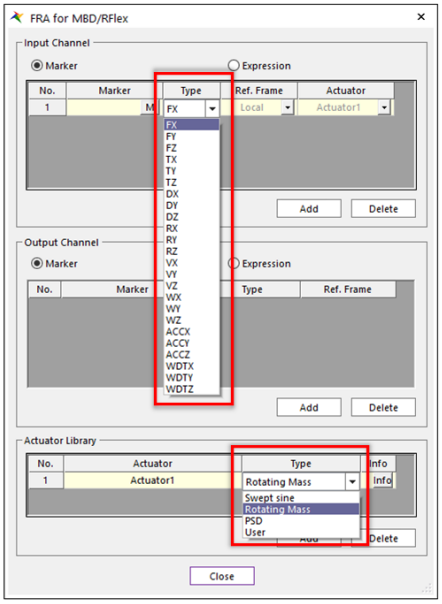
Improved Reference Definition Function for Contour's Displacement Results

When checking the Displacement results in the existing contour, the Reference Node could only be specified as the Node belonging to the same FFlex body. In RecurDyn 2023, it is now possible to define a Reference Marker as well as a Reference Node. The Reference Marker may belong to anybody in the model.



Improved FRA Excitation Loads

The Input Type and Actuator Type have been added in FRA Excitation Loads (Excitation Loads for RFlex and Rigid Body) of [Flexible Tab]→[FRA Group].



- Input Type: Can be the translational displacement / velocity / acceleration, or the rotational displacement / velocity / acceleration
- Actuator Type: Can be a Swept sine function, a Rotating Mass, a PSD (Power Spectral Density), or a User (User-Defined Function)

Toolkits

Improved eTemplate

Considering RecurDyn/Professional, more than 90% of the functions supported by ProcessNet are also supported by eTemplate. In addition, 'S4PARK' has been removed from the name of eTemplate's ModuleKey (Example: S4PARK_Module_Professional → Module_Professional). Therefore, modifications are required when using previously created eTemplate Excel files.

	A	B
1	**Template_Format_Definition**	**Value**
2	ModuleKey	Module_Professional
3	TemplateMode	FreeStyleMode
4	UserCommentColumn	0

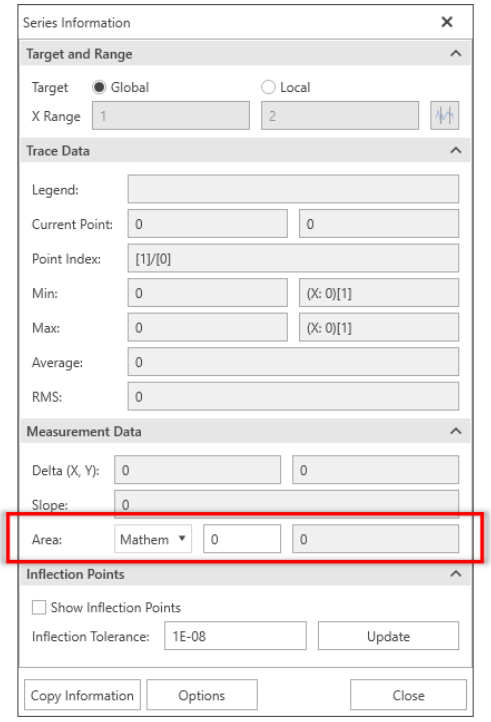
For more details, refer to [...₩FunctionBay, Inc₩RecurDyn 2023₩Help₩eTemplate₩eTemplate_Helper.xlsm]

	Total number of options (excluding Toolkit)	V9R5 Implementation rate (%)	V10R1 Implementation rate (%)	Number of unimplemented options
Geometry	173	32.9	92.4	13
Home/Setting	360	9.7	95.3	17
SubEntity	93	63.9	100	0
Analysis	272	29.3	99	3
Sensor	30	66.7	90	4

Improved RecurDyn Post

Various improvements have been made to RecurDyn Post.

- RecurDyn Post supports ProcessNet.
- Area calculation to Series Information: It is now possible to calculate the area (integral value) based on the data selected in the plot. Both Mathematical and Absolute are supported for the area calculation. The users can also specify the baseline of the area directly.



- Added Annotation: The Annotation function has been added to the Toolbar. It provides four types: Text, Line, Arrow, and Vertical Line. The 'Invisible' function in the right-click menu in the Database enables hiding a created Annotation from the Plot. The users can also select and apply various styles, such as borders, line thicknesses, and background colors.
- Data Highlight: When selecting the Data in the Plot, the corresponding Data is highlighted in the Data table.

ProcessNet

Improved ProcessNet

- Supports the 'Synchronize with Geometry' option for contact-related objects

Tutorials

New Tutorials

- FFlex: Bimetal Thermometer (Tutorial on performing MFBD simulation including thermal analysis)