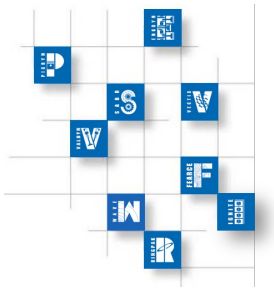
Ricardo Software

Release Notes



Version 2018.1
June 2018

Table of Contents

1. R-Desk

This note announces the release of R-Desk version 2018.1 which supersedes the previous release 2017.1.

R-Desk is the Graphical User Interface for interacting with FEARCE, IGNITE, VALDYN (kinematics), WAVE and VECTIS; for post-processing 3D FE models output by ENGDYN, FEARCE, PISDYN, and VALDYN and 3D CFD results output by VECTIS using the Viewer; and for setting up analysis workflows using Project. Users are advised to refer to the R-Desk and relevant product manuals for usage instructions.

This version of R-Desk is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

Corrections	
R3D-745	Flood picking VECTIS `.POST` files does not work as expected
Flood picking could work incorrectly on VECTIS PHASE5 `.POST` files which had multiple zooms/domains. This would lead to all of the model being selected rather than just the chosen domain. This problem has been addressed.	
R3D-779	FE-Graph tool in R-Desk Viewer uses incorrect default value for Sound Pressure P_{ref}
The default value for Sound Pressure P_{ref} was $10\ \mu Pa$ rather than $20\ \mu Pa$ as it should be (defined by IEC 801-22-07). This problem has been addressed. This problem relates to FEARCE-5644 an issue with the PLOT Command in FEARCE.	
RDESK-6113	Crash when opening Help from non-R-Desk GUIs
Any non-R-Desk GUI would crash intermittently if R-Help was already open and help was launched from the non-R-Desk GUI. This problem has been addressed.	
RMODEL-3527	R-Desk Viewer crashes using right mouse in full screen mode
R-Desk Viewer crashed using right mouse in full screen mode. This problem has been addressed. As part of this change the context menu now works as expected in full screen mode.	

2. FEARCE

This note announces the release of FEARCE version 2018.1. This supersedes the previous release, which was FEARCE 2017.1.

FEARCE is a finite element environment for pre-processing, solving and post-processing, and management of processes and data between different programs and systems. Users are advised to refer to the FEARCE product manual for usage instructions.

This version of FEARCE is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

Related release notes include:

- Material Editor
- R-Desk
- RPlot
- SDFBrowser

2.1. FEARCE

Enhancements	
FEARCE-5575	EXPORT Command now supports exporting from a read-only `.SFE` file
If an `.SFE.` file is opened using the OPEN Command with `INTENT=READ` then the EXPORT Command will now export data from it rather than terminating with an error.	
FEARCE-5615	PRINT Command now writes transient stress and strain results as transient
The PRINT Command has been updated so that transient stress, strain and plastic strain results are now written as transient consistent with their transient displacements enabling displacements, stress and strain results to be written to the same table of data. If present, `TRANSIENT_DISPLACEMENT_TIMES` are used for the printed `TRANSIENT_TIMES`, otherwise the `TRANSIENT_TIMES` are derived from the load case name corresponding to the transient stress case. Related to this change is FEARCE-5638.	
FEARCE-5632	SET Command `RESULTS` now supports creating a set from modal data

The SET command has been extended so that the `RESULTS` argument now supports mode shape data:
 	
`MODE_SHAPES_X`
`MODE_SHAPES_Y`
`MODE_SHAPES_Z`
`MODE_SHAPES_PHIX`
`MODE_SHAPES_PHIY`
`MODE_SHAPES_PHIZ`
`MODE_SHAPES_MAGNITUDE`
 	
In this case `RESULTS_LOADCASE` corresponds to the mode number.
 	
Also as part of this change:
 	
• `RESULTS_REGIONS` now also takes an optional additional value to limit the number of sets created.
• If the SET using `RESULTS` would contain all nodes or elements it is no longer created.	

FEARCE-5634	PRINT Command now writes `** none **` for any missing data
The PRINT Command left a blank or omitted the column of values altogether when the requested data was not present. This was misleading particularly when the number of columns did not match the header. To resolve this `** none **` is now printed for any missing data.	
FEARCE-5638	PRINT Command now has explicit transient time base options

Enhancements

The PRINT Command now has explicit transient time base options:

```
TRANSIENT_ANGLE
TRANSIENT_STEP
```

in addition to `TRANSIENT_TIME` to enable the time base to be written as angle or step as well as time. The values are decoded from loadcase names in the same way as `TRANSIENT_TIME`.

These options are only valid for the following time based data:

- Transient data stored in:

  ```
  TRANSIENT_ACCELERATION_*
  TRANSIENT_DISPLACEMENT_*
  TRANSIENT_VELOCITY_*
  ```

- Stress, strain and plastic strain data corresponding to the following time based displacement data:

  ```
  TRANSIENT_DISPLACEMENT_*
  DISPLACEMENT_RESULT_*
  ```

Note

These options are not currently supported for Quasi-Transient displacement data stored in `DISPLACEMENT_RESULT_*`

FEARCE-5654	SOLVE Command `ANALYSIS=BACKSUBSTITUTE DISPLACEMENT=TRANSIENT` now calculates all transient data

The FEARCE Data Recovery GUI object and corresponding SOLVE Command `ANALYIS = BACKSUBSTITUTE` with `DISPLACEMENT=TRANSIENT` now calculates all transient data to give

```
TRANSIENT_ACCELERATION_VALUES
TRANSIENT_VELOCITY_VALUES
```

as well as

```
TRANSIENT_DISPLACEMENT_VALUES
```

This applies to each of the supported reduced models.

FEARCE-5660	Data Recovery of VALDYN VRFOLLOWER_V2 Object

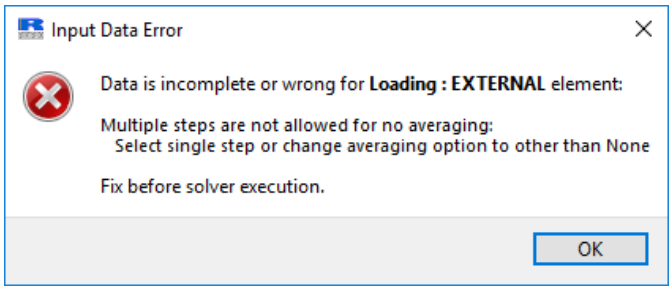
The FEARCE Data Recovery GUI object and corresponding SOLVE Command `ANALYIS = BACKSUBSTITUTE` have been updated to support data recovery of the VALDYN enhanced Swinging Follower VRFOLLOWER_V2 object added as part of this release (MECH-10148).

Corrections

FEARCE-5202	FEARCE Interpolation Object doesn't support multiple steps without Averaging

Corrections

The FEARCE GUI would pop-up the following Input Data Error:



when using any of the Interpolated convection, flux or temperature obects with multiple steps selected and Averaging set to *None*. This error was invalid since FEARCE supports this functionality. This problem has been addressed.

FEARCE-5541	FEARCE GUI fails to save Thermal Spring data correctly

The FEARCE GUI failed to write `TYPE=THERMAL` for thermal springs resulting in a failure of the FEARCE solver. This problem has been addressed.

This relates to

FEARCE-2648

FEARCE-5543	System tolerance is incorrect if model doesn't contain any solid elements.

If a model only contained mass elements, calculating the system tolerance with `STATUS TOLERANCE=0.0` resulted in a value of `5.0E19` being used. This problem has been resolved such that *half the distance between closest nodes* is now calculated irrespective of element connectivity.

In addition the EDIT and NODE commands will now also cause re-calculation of this tolerance (as the IMPORT command did before).

Related to this is FEARCE-5587.

FEARCE–5565	Error converting Couplings to Multi Point Constraint (MPC) equations

FEARCE would fail with the following error:

```
ERROR 9 from FPDOFC
Attempting to Repeat node 50000001 direction 4
already used as an independent dof in a repeat
```

when converting Couplings to MPC equations dependent on the definition of the couplings. This problem has been addressed, such that this condition is no longer a constraint conflict and is converted to an MPC as expected.

FEARCE-5571	PROPERTY Command uses a different triangulated mesh on Linux and Windows

The triangulated mesh for calculating the properties of a beam section was different on Linux and Windows. This problem has been addressed.

This relates to

FEARCE-5369

FEARCE-5574	Error performing backsubstitution.

Corrections

FEARCE would fail with the following error:

```
Error in sdf_where_chan
No memory allocated for "FE:FPBSCMS_GOA_CRET".
Error in Sdf_Where
Error 3025 reported by "sdf_where_chan".
Error in sdf_where_chan
```

due to the dependent terms of Multi-Point Constraint (MPC) equations not being processed correctly. This problem has been addressed.

FEARCE-5580 VIBRATION Command error performing Fast Fourier Transform (FFT)

If a large even number of `STEPS` was specified and the internal working internal limit was exceeded FEARCE would fail with the following error:

```
ERROR 9 from RF_FFTR
Array bounds exceeded.
```

The allowable number has been signicantly increased which should be adequate for most practical purposes. However if a prime factor of the number of `STEPS` exceeds 503, or its radical exceeds 5003, then it will still fail with the same error.

FEARCE-5585 FEARCE GUI fails to save Couplings correctly to `.frx` or `.FRC` file

If a Coupling object was set to Rigid and saved to file the Coupling was incorrectly saved as Average. This problem, which has now been addressed, was dependent on whether or not the object was selected when the file was saved.

FEARCE-5587 FEARCE Solution fails if the model only has Mass, Spring and Damper elements

As a consequence of resolving FEARCE-5543 the solution would fail with the following error:

```
write error in VSS Solver
requested write of 8bytes but actually wrote 0bytes
```

if the model only contained Mass, Spring and Damper elements. This problem has been addressed such the distance between nodes of a given spring or damper must now be less than the `TOLERANCE` defined using the STATUS Command. This change means that the DAMPER and SPRING Commands are now consistent with the JOIN Command.

FEARCE-5594 FEARCE fails executing a translator using the OPEN, IMPORT or EXPORT Commands

FEARCE would intermittently fail with the following error (or similar):

```
ERROR 2 from FPRUN_BAT
Problem whilst running wvtosf
```

when executing a translator from the `.FRC` file using either the OPEN, IMPORT or EXPORT Commands. This was a problem with pipe communication with the translator, and has been addressed.

FEARCE-5606 FEARCE fails reading variable material proerties from a `.rmt` file

Corrections

FEARCE would fail with the error:

```
BUG 25 from rmatlibf
Variable material array too small for data (1000 cf. 1212)
```

when the number of variable material values exceeded 1000 values. This problem has been addressed such that the limit has been increased to 10000 values. Also the error message has been improved, should this limit be exceeded in the future.

Note

The number of values corresponds to the *number of data points x number of variables*.

FEARCE-5613	Step or crank angle index overflow in loadcase names means that data is not displayed as expected in R-Desk Viewer

For any step or crank angle index greater than 9999, the loadcase name would be written as:

```
L001DB1#CA****#999.90
```

which meant that the data was displayed as Static rather than as Transient in R-Desk Viewer. This problem has been addressed such that five digits rather than four are available for angle numbers up to 99999.

This relates to

FEARCE-5502

FEARCE-5614	LOAD_COMPONENT Command writes zero pressure to `.FRC` file which results in an error

The LOAD_COMPONENT would write the pressure regardless of it's value. If the pressure was zero then this would cause FEARCE to fail with the following error:

```
ERROR 9 from FPCPRS
All Forces and pressures are zero in PRESSURE command.
```

This problem has been addressed such that the PRESSURE Command is no longer written to the `.FRC` file if the pressure is zero.

FEARCE-5626	SAFETY Command gives incorrect safety factors using `USER_DEFINED` Haigh Line

The SAFETY Command option `TYPE=HAIGH CURVE=USER_DEFINED` may have given incorrect results due to uninitialised values. This problem has been addressed.

FEARCE-5628	Data Recovery Option *Displacement and Stress* doesn't calculate any stresses

The FEARCE GUI did not write the commands correctly for the Data Recovery Option *Displacement and Stress* with Displacement set to *Transient*. This meant that that no stresses were calculated. This problem has been addressed.

FEARCE-5636	SHAPE Command best-fit cylinder gives the incorrect answer

Corrections

The algorithm for deriving a best-fit cylinder from a set gave a poor fit, in particular if the set only formed part of a cylinder. This algorithm is used in each of the following FEARCE Commands:

- BEARING
- BOLT
- DISTORTION
- SHAPE

together with the Mechanical Suite of programs, and as such was a problem in each of the applications of this feature. This problem has been addressed.

Note

The DISTORTION Command is quite sensitive to the fitted cylinder and differences in results may be noticeable due to this change. As such `STATUS BIG` may need to be added or changed to increase the size of the `BIG` tolerance.

FEARCE-5644	PLOT Command `PLOT = SOUND_PRESSURE` gives sound pressues (in dB) that are half of what they should be

The values of sound pressure in dB written by the PLOT Command were half of what they should be, as if the pressures were not the log of the squared value of P/P_{ref} . This problem has been addressed such that the pressures are now:

$$SPL = 20.log\left(\frac{P}{P_{ref}}\right)$$

as they should be (defined by IEC 801-22-07).

This problem relates to R3D-779 an issue in the FE-Graph tool in R-Desk Viewer.

FEARCE-5674	VELOCITY Command creates invalid loads for `PROFILE=VECTIS INTERPOLATION_METHOD=POINT`

The Z-Component of the generated nodal fluid velocity loads (`NODAL_FLUID_VELOCITY_LOADS`) could be incorrect when interpolating from VECTIS with `PROFILE=VECTIS` and `INTERPOLATION_METHOD=POINT_LOAD`. This problem has been addressed.

Documentation

FEARCE-5618	Updated tutorials

The format of the tutorials have been updated to be consistent with other Ricardo Software products and are now delivered as part of the manual `FEARCE_2018.1_Manual.pdf` rather than as separate documenets in `../Docs/Manuals/FEARCE`.

2.2. FE Translators

- Abaqus
- ADVC
- ANSYS
- Nastran
- OptiStruct
- Pamcrash

2.2.1. Abaqus

Enhancements	
TRAN-2139	sftoab now writes `MPC=NO` when requesting the full mass matrix for CMS Reduction

sftoab now writes:

```
*MATRIX GENERATE, MASS, MPC=NO
```

to the `.inp` file when using the `-matrix_extraction` option to perform a CMS Reduction. This avoids potential problems with a non positive-definite mass matrix when the reduced matrices are used by VALDYN.

Note

sftoab is now consistent with the Nastran sftona and OptiStruct optona translators in writing the mass matrix at all degress of freedom (DOF).

Warning

It is advised that all DOF of a given model have non-zero mass and inertia, and that small mass elements are added to any non-structural nodes if necessary.

Corrections	
TRAN-2129	abtosf crashes writing gap status results read from a `.fil` file

abtosf would intermittently crash writing gap status results read from a `.fil` file. This problem has been addressed.

2.2.2. ADVC

There are no changes to the ADVC translator in this release.

2.2.3. ANSYS

Corrections	
TRAN-2056	antosf fails to read `MPDATA` correctly if `SLOC` is left blank

If `SLOC` was not specified then antosf would fail attempting to overwrite property data resulting in the following error:

```
ERROR 1 from routine FPVMTS
Conflicting duplicate properties for material 1
```

This problem has been addressed such that `SLOC` no longer has to be specified.

Note

`MPDATA`	Property data to be associated with the temperature table
`SLOC`	Starting location in table for generating data

TRAN-2134	Heat Transfer Coefficient (HTC) set to some random value by antosf if not specified in the ANSYS `.dat` file

If no Heat Transfer Coefficient (HTC) value was defined for a thermal contact in the ANSYS `.dat` file then antosf would potentially set this to some random value in the `.SFE` file, rather than `0.0` as it should be. This problem has been addressed.

2.2.4. Nastran

Corrections	
TRAN-2121	The `MATT1` Bulk Data card is incorrectly written to the `.dat` file by sftona

sftona wrote the T(A) field as 0 rather than as blank resulting in a fatal error when running Nastran version 20140 or later. This problem has been addressed such that a blank is now written for this field.

Note

T(A) - Identification number of a TABLEMi entry for the thermal expansion coefficient.

TRAN-2124	natosf crashes writing `CBUSH` damper properties to the `.SFE` file

natosf failed to write `CBUSH` damper properties correctly to the `.SFE` file when reading this data from a `.dat` or `.f12` file, which may have resulted in a program crash. This problem has been addressed.

2.2.5. OptiStruct

Corrections	
TRAN-2124	optosf crashes writing `CBUSH` damper properties to the `.SFE` file
optosf failed to write `CBUSH` damper properties correctly to the `.SFE` file when reading this data from a `.fem` or `.op2` file, which may have resulted in a program crash. This problem has been addressed.	

2.2.6. Pamcrash

There are no changes to the Pamcrash translator in this release.

2.3. CFD Translators

- cldtosf
- wvtosf
- xfdtosf

2.3.1. cldtosf

Corrections	
TRAN-2118	cldtosf fails to write messages as expected
	cldtosf failed to write a number of messages to standard output as expected. This problem has been addresed. Related to this is FEARCE-5594.

2.3.2. wvtosf

Corrections	
TRAN-2118	wvtosf fails to write messages as expected
	wvtosf failed to write a number of messages to standard output as expected. This problem has been addresed. Related to this is FEARCE-5594.

2.3.3. xfdtosf

Corrections	
TRAN-2118	xfdtosf fails to write messages as expected
	xfdtosf failed to write a number of messages to standard output as expected. This problem has been addresed. Related to this is FEARCE-5594.

2.4. Utilities

- calmas
- Feviewer
- mattoxml

2.4.1. calmas

There are no changes to calmas in this release.

2.4.2. Feviewer

There are no changes to Feviewer in this release.

2.4.3. mattoxml

There are no changes to mattoxml in this release.

3. IGNITE

This note announces the release of the 2018.1 version of IGNITE.

IGNITE is a multi-domain system modelling and simulation software which includes modelling libraries suitable for various automotive applications such as a drive cycle, performance and thermal system analysis. The diverse range of modelling libraries are also equally applicable for system analyses in a wide variety of different industrial sectors; this might include Off-Highway, Rail, Defense and Water distribution.

This version of IGNITE is available for 64-bit Windows (win64). Please see the Platform Policy for specific details.

IGNITE 2018.1 uses the Modelon Optimica Compiler Toolkit (OCT) solver to perform simulations. The installation of OCT is included with the Ricardo Software installer so no additional installation steps are required.

These release notes are separated into the following sections:

- IGNITE

NEWS!

A new library named **IMoVeD Library (Ignite Modelica Vehicle Dynamics)** has been added to Ricardo libraries. The library is suitable for the vehicle handling and tire performance simulation. It includes various components of the tires, axles, differential and road definitions.

Other related release notes include:

- R-Desk
- Run Distribution Manager

3.1. IGNITE

Enhancements	
RMODEL-3376	IGNITE supports Run Distribution Manager (RDM) heartbeat
IGNITE has been updated to support the RDM heatbeat introduced in this release, allowing an RDM job to be shutdown in a controlled manner thereby releasing all licences used by that RDM job.	

Corrections	
IGNITE-1573	Event causing the gear ratio to reinitialize to a fallback (NEUTRAL) value = 1.0
The selection of the gear ratios have been improved especially during launches of the vehicle.	
IGNITE-1616	Data of nested reference objects not written to the IGNITE results file when parametrized
This correction enables the access to the output data of the parametrized nested reference objects.	

4. Mechanical Suite

4.1. ENGDYN

This note announces the release of ENGDYN version 2018.1. This supersedes the previous release, which was ENGDYN 2017.1.

ENGDYN is a computer program for analysing the dynamics of the engine and in particular the dynamics of the crank train and its interaction with the cylinder block.

This version of ENGDYN is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

- ENGDYN

Related release notes include:

- FEARCE
- FE Translators
- Matutil
- R-Desk
- RPlot
- SDFBrowser

4.1.1. ENGDYN

Major Enhancements	
MECH-9810	ENGDYN now supports user-defined sets when defining reduced models

The user is now able to read any appropriate set from the `.SFE` when adding a set to a reduced model allowing the user to use their own set names and/or set naming convention rather than the pre-defined names used by ENGDYN such as `mainBearing:ID_1`. This applies to reduced models of the following components:

- Connecting Rod
- Cylinder Block

Note

ENGDYN will alias each user-defined set to the appropriate pre-defined name, such as `mainBearing:ID_1`, and will continue to use that name internally for messaging and referral during post-processing.

MECH-10603	Order of magnitude speed-up of Static EHL solutions

The solution of static EHL problems are now typically 10 times faster than 2017.1 dependent on the size of the lubrication mesh and the number of reduced Degrees of Freedom (DOF). This speed-up has been achieved by analytically deriving the terms of the Jacobian matrix related to the Reynolds Equation, rather than by perturbation, which was the case previously.

This relates to the PISDYN change MECH-10524.

Note

This applies to all options with the exception of *Model (Boundary Conditions)* set to Reynolds, JFO, Elrod (Deprecated) or if the SOLUTION Command argument `BEARING_OPTIONS` is set to `BEARING_OPTIONS = REDUCED_MESH`.

Known Issue

It is known when using the Half-Sommerfeld Boundary Condition that the solution might fail with this update, particularly if used in combination with the Patir & Cheng Average Flow Model. For this reason an additional option called `PERTURBED_JACOBIAN` has been added to the SOLUTION Command argument `BEARING_OPTIONS`.

Setting `BEARING_OPTIONS = PERTURBED_JACOBIAN` will evaluate the Reynolds Equation terms of the Jacobian matrix by perturbation.

Enhancements	
MECH-10461	ENGDYN now supports a user-defined rigid body tolerance for dynamic models

The Matrix Reduction Panel now supports a user-defined Rigid Body Tolerance when reducing dynamic models. This defines the frequency value below which modes are assumed to be rigid body modes. This applies to reduced models of the following components:

- Connecting Rod
- Cylinder Block

Corrections	
MECH-10559	Static EHL solution fails with multiple cases and processors

Corrections	
When running a model with an EHL bearing with multiple cases and more than one processor the deformations from the previous case were being used incorrectly as the initial condition resulting in failure of the solution. This problem has been addressed.	
MECH-10734	Unable to define an angled groove using the ENGDYN GUI
The ENGDYN GUI would fail with a pop-up error: `Problem generating lubrication mesh` when attempting to define an angled groove. This problem has been addressed.	
MECH-11448	ENGDYN GUI crashes opening an incomplete model
If a model was saved before any crankshaft mass properties were defined then the GUI would crash when attempting to re-open the `.EDSF` file. This only applied to the following crankshaft model types: • Rigid with Mass • Compliant with Mass • Dynamic This problem has been addressed.	
MECH-11540	ENGDYN fails with a convergence error performing an EHL solution with an angled groove
ENGDYN failed with a convergence error after the first initial steps when performing a dynamic EHL solution with an angled groove. This was a consequence of using a periodic-spline function when mapping data between the journal and bearing, and may have resulted in robustness issues for any EHL bearing solution regardless of whether a bearing had an angled groove or not. The use of a periodic-spline function to map these data was introduced in ENGDYN 2017.1. This problem has been addressed by reverting to a linear function. Differences in results between this release and 2017.1 as a consequence of this change will be negligible.	
MECH-11672	Static EHL simulation fails beyond the 20th step
In static EHL simulations the solver would fail at the 21st step when introducing the compliance into the solution. This was due to a memory allocation error defining the mesh for the elastic deformations when initialising the EHL simulation. This problem would only occur, if at all, when there was more than one HD or EHL bearing. This problem has been addressed and should result in a more robust start of static EHL simulations.	
MECH-11634	Too many out of range temperature warnings

Using either the *Thermal Balance, Axial* or *Thermal Balance, Nodal* options the oil temperature could exceed the maximum temperature of the stored oil viscosity - temperature data, resulting in the following warning:
`WARNING 1 from OBVISC0`
`Requested temperature 427.30 degC outside range of temps defining oil`
`Using viscosity at 300.00 degC`
This would potentially result in a large number of warnings, and a prohibitively large `.out` file. This problem has been addressed.	

MECH-11637	Unrealistic oil and metal temperatures using *Thermal Balance, Nodal* option

Corrections

Using either the *Thermal Balance, Axial* or *Thermal Balance, Nodal* options the local oil (and metal) temperatures could exceed $800\ degC$ in locations where the bearing clearance was very small ($< 0.1\ micron$) and was a consequence of very high hydrodynamic power loss. This problem has been addressed by limiting the hydrodynamic power loss such that for clearances below $0.1\ micron$ the hydrodynamic power is assumed to be 0.0.

As part of this change when adding a Lubricant using either the Lubrication Definitions Panel or LUBRICANT Command the oil viscosity is now saved from $-100\ degC$ to $600\ degC$.

This also relates to MECH-11634.

MECH-11676	`accelerometer` sets are incorrectly added as constrained node sets

Any `accelerometer` set was incorrectly added to a given reduced model as a constrained node rather than as a node set. This problem has been addressed.

MECH-11711	`Add Matched Nodes Only` option fails to add sufficient reduced dofs and results in errors during assembly

For certain bearing geometries that include oilholes or grooves the `Add Matched Nodes Only` option would fail to add sufficient nodes to the reduced model resulting in errors during assembly similar to:

```
Error in RMLCONROD_ASSEMBLY
Unable to find radial dof for connecting rod node    79248
```

This problem applied to the following components:

- Connecting Rod
- Cylinder Block

and has been addressed.

Note

This change may result in a slightly higher number of reduced model dofs when using the `Add Matched Nodes Only` option compared with previous releases.

MECH-11758	Elastic deformation of connecting rod HD bearings is neglected for a Dynamic solution with a rigid block

For a dynamic solution of an HD bearing the elastic deformation of the bearing is assumed to be the average deformation of the bearing surface. If the model included a rigid block, this deformation was neglected for any connecting rod HD bearings also included in the model. This problem has been addressed.

MECH-11800	The nodal coordinate displayed by the Summary Panel for any web node is incorrect

The nodal coordinate for any node associated with a web was incorrect when displaying Lumped Masses, Dampers or Mechanical Links using the Summary Panel. This problem has been addressed such that the displayed coordinate is now correct and therefore consistent with the corresponding edit panel for each object type.

MECH-11809	`.EDSUM` file contains `Min. Void Fraction` output when it shouldn't

For a mobility solution there was a extra line in the `.EDSUM` file, containing `Min. Void Fraction` values, when it shouldn't. This problem has been addressed.

MECH-11850	Error calculating pressures for keystone-shaped small end HD/EHL bearing

Corrections	
The pressures calculated on the bearing of a keystone-shaped small end HD/EHL bearing were in slight error due to an inconsistent calculation of the finite volume cell areas on the bearing mesh. Most likely this resulted in small but negligible differences. This problem has been addressed.	
MECH-11874	Static HD solution gives different results with multiple cases
When running a model with an HD bearing with multiple cases the results were different for a given speed dependent on how many cases were executed. This was a consequence of a number of variables not being reinitialised between cases. This problem has been addressed.	

4.2. PISDYN and RINGPAK

This note announces the release of PISDYN and RINGPAK version 2018.1. This supersedes the previous release, which was PISDYN and RINGPAK 2017.1.

PISDYN and RINGPAK are dynamic simulation programs concerned with the prediction of piston secondary motion and the behaviour of the piston ring pack. Users are advised to refer to the PISDYN and RINGPAK product manuals for usage instructions.

This version of PISDYN and RINGPAK is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

- PISDYN
- Pisview
- Rapid
- RINGPAK
- Ringvis

Related release notes include:

- FEARCE
- FE Translators
- Matutil
- R-Desk
- RPlot
- Run Distribution Manager
- SDFBrowser

4.2.1. PISDYN

In the following notes 2016.1 PISDYN solver refers to the *PISDYN - Dynamics (Flexible Bearings, pin and conrod)* solver introduced in 2016.1.

Major Enhancements	
MECH-10524	Speed-up of dynamic solutions using the 2016.1 PISDYN Solver

Dynamic simulations using the 2016.1 PISDYN Solver are now typically between 4 to 10 times faster than 2017.1 dependent on the size of the lubrication mesh and number of reduced Degrees of Freedom (DOF). This speed-up has been achieved by analytically deriving the terms of the Jacobian matrix related to the Reynolds Equation, rather than by perturbation, which was the case previously.

So as to provide backwards compatibility Rapid has been updated to allow the Jacobian matrix to be derived by perturbation (MECH-11834).

This relates to the ENGDYN change MECH-10603.

MECH-11715	Support of Design of Experiments (DoE) studies

PISDYN now supports the generation of multiple model files from a single parent file, enabling the solution of multiple cases for Design of Experiment studies.

This feature is invoked from the command line using the `-generate` switch as follows:

```
pisdyn -generate [-output <file>] [-first <number>] <model file> <definition file>
```

where the multiple cases are defined in a separate `<definition file>`.

This relates to the following Issues:

- MECH-11551
- MECH-11742

Enhancements	
MECH-10413	Improved validation of reduced model data

The validation of reduced models has been improved so that the existence of mandatory sets for any given component is now verified. If a mandatory set is not present in the model an error similar to:

```
ERROR 2 from VALIDATE_REDUCED_MODELS
Mandatory set 'constraint:ID_cutPlane' does not exist
Please re-define the connecting rod reduced model
```

is reported and the user is requested to re-define the model.

This change prevents subsequent problems or crashes with incorrectly defined models.

MECH-11320	Improved validation of temperature input data

The validation of temperature input data w.r.t. the lubricant temperature data range has been improved such that:

- PISDYN now checks FE supplied temperature as well as tabulated temperatures
- PISDYN now checks the minimum and maximum average temperature for given a interface rather than the temperature of each surface
- Error messages have been improved

This relates to

MECH-11288

MECH-11551	PISDYN supports Run Distribution Manager (RDM) heartbeat

PISDYN has been updated to support the RDM heatbeat introduced in this release, allowing an RDM job to be shutdown in a controlled manner thereby releasing all licences used by that RDM job.

To facilitate this change the following command line options have been added:

`-noheartbeat`	Disable the heartbeat	
`-timeout`	The allowable period of time in secs that RDM can be disconnected from the network	[Default = 5 secs]
`-missed_beats`	The number of heartbeats that are missed after which the RDM job is stopped	[Default = 1]

This also relates to MECH-11735.

MECH-11556	2016.1 PISDYN solver now outputs the last non-converged step

To facilitate debugging of non-converging dynamic simulations, the PISDYN solver released in 2016.1 now saves the results from the last attempted, but failed time step into the `.pdsf`, `.asc` and `.psc` output files.

Note

Due to this change the summary values in the `.psc` file will likely be non-physical. As such an appropriate warning message is written to the `.out` file.

Corrections	
MECH-11378	PISDYN requests a `VALKIN_SOLVER` license and fails to write the `.rapx` file
The PISDYN solver requested a `VALKIN_SOLVER` when attempting to write the `.rapx` file for display of graphical results data in R-Desk. This problem has been addressed.	
MECH-11513	`-reduce` command line option overwrites set definitions already in the file
The `pisdyn -reduce` command line option always re-created the reduced model from scratch. This potentially lead to significant changes to the model defined in Rapid, for example re-creating sets that the user had deleted in the GUI. This problem has been addressed such that the `-reduce` option is now equivalent to reducing and assembling the model in Rapid without opening the Define Model Panel. This was always the intended behaviour.	
Note This correction does not apply to models where the `.SFE` file is defined in the `.rap` file.	
MECH-11525	PISDYN crashes with a compliant small end connecting rod model
The PISDYN solver crashed when reading any model with a compliant small end connecting rod. This problem has been addressed.	
MECH-11538	Forces near TDC are incorrect with negative piston head clearance
The forces and liner deformations near TDC for models with negative piston clearance were spiky and not as expected. This problem has been addressed and was a consequence of MECH-10986 Furthermore, validation of the model has been improved such that: • land boundary pressures are validated w.r.t. cavitation pressure, and • the number of axial lubrication mesh nodes on the crown now must be high enough to ensure that at least three nodes remain in the liner at TDC when the piston head clearance is negative.	
MECH-11549	PISDYN solver switches components to rigid rather than failing
In a dynamic simulation with flexible components using the 2016.1 PISDYN solver the solution would on occasions switch the flexible components of the piston to rigid and continue to completion, rather than failing as it should have done. This occurred at the end of the first 20 steps when the compliance was introduced. This problem has been addressed.	
MECH-11640	Bearing lubrication forces are incorrectly mapped onto pin
In a dynamic simulation involving a flexible wristpin, the lubrication forces acting on the pin were not calculated entirely correctly which may have resulted in the solution failing. This problem has been addressed.	
MECH-11672	PISDYN solver fails beyond the 20th Step
In a dynamic simulation with flexible components using the 2016.1 PISDYN solver the solution would fail at the 21st step when introducing the compliance into the solution. This was due to a memory allocation error defining the mesh for the elastic deformations when initialising the EHL simulation. This problem would only occur, if at all, when there was more than one HD or EHL lubricated interface (for example piston-liner and small end bearing.) This problem has been addressed and should result in a more robust start of EHL simulations using this solver.	
MECH-11850	Negative asperity pressure on the piston when crossing a port on the cylinder bore

Corrections
On rare occasions, in a dynamic simulation using the 2016.1 PISDYN solver negative asperity pressure was predicted on the piston when it was crossing a port on the cylinder bore. This was caused by an inconsistent calculation of the finite volume cell areas on the liner lubrication mesh, and as such may result in small but negligible differences generally. This problem has been addressed.

4.2.2. Pisview

There are no changes to Pisview in this release.

4.2.3. Rapid

Major Enhancements	
MECH-9810	Rapid now supports user-defined sets when defining reduced models for PISDYN

The user is now able to read any appropriate set from the `.SFE` when adding a set to a reduced model allowing the user to use their own set names and/or set naming convention rather than the pre-defined names used by Rapid (PISDYN) such as `pistonSkirt`. This applies to reduced models of each component support by Rapid (PISDYN).

Note

Rapid (PISDYN) will alias each user-defined set to the appropriate pre-defined name, such as `pistonSkirt`, and will continue to use that name internally for messaging and referral during post-processing.

This relates to MECH-11513.

Enhancements	
MECH-9752	Update of piston reduced model when piston bearing model is switched from (E)HD to mobility (or vice versa)

Rapid now updates an existing piston reduced model when the piston bearing model is switched from (E)HD to mobility (or vice versa). The following apply:

- In both cases, any existing piston bearing face sets are deleted and re-added using the current set definitions.
- When switching to mobility, reduced degrees of freedom are removed from the bearing sets.
- Conversely, when switching to (E)HD, reduced degrees of freedom are added to the bearing sets.

The user is then required to repeat the piston model reduction (typically when switching to (E)HD model) and assembly as in previous versions.

MECH-11570	Compression Ring with Chamfer Cutout

The Ring Cutout Definition Panel now supports a *Chamfer (Width and Angle)* cutout definition for a compression ring.

This relates to MECH-11443.

MECH-10750	RINGPAK Enhanced End Gap Gas Dynamics

To enable the RINGPAK enhanced end gap gas dynamics model implemented by MECH-10217 the *Gas dynamics* option menu of the Ring Dynamics Solution Panel (at Model Options tab > Dynamics tab) has been updated to support the following options:

- Disabled (for Motored Condition)
- 3-Way (pre-2018.1)
- Y-Junction, Coupled Thermal Solution (Recommended)

Note

- These options only apply to the 3D-Ready solver.
- For the 3D-ready solver the 3-Way model is retained for backwards compatibility only.
- The 3-Way model is the model that is always used by the 2D-Axisymmetric solver.

MECH-10461	Rapid now supports a user-defined rigid body tolerance for dynamic models

The Matrix Reduction Panel now supports a user-defined Rigid Body Tolerance when reducing dynamic models. This defines the frequency value below which modes are assumed to be rigid body modes.

Enhancements	
MECH-11834	Speed-up of dynamic solutions using the 2016.1 PISDYN Solver

To enable the speed-up of dynamic solutions using the 2016.1 PISDYN Solver as implemented by MECH-10524 and to provide backwards compatibility an additional *Jacobian Matrix* option menu has been added to the Piston Solution Panel which has the following options:

- Derived Analytically (Recommended)
- Derived by Perturbation

MECH-11894	Unmatched liner lubrication mesh nodes for models with ports are now reported

When adding the `cylinder:CYL_1:ID_bore` set to the liner reduced model or when assembling the liner reduced model, Rapid detects lubrication mesh nodes that do not match the FE model. Rapid now reports these unmatched nodes as:

```
Message from RMLLINER_CHECKUNMATCHED
Unmatched lubrication mesh node 4325 found outside of a cutout or user-defined port
```

In previous release these unmatched nodes were unreported leading to possible failure of the PISDYN solution.

When the set is being added to the reduced model, unmatched lubrication mesh nodes are also indicated by red crosses in the 3D view.

Corrections	
MECH-10033	Rapid fails to update the `.SFE` file resulting in an error during reduction

The update of set names in the `.SFE` file was only done when opening the Define Model Panel. If the user went straight to the Model Reduction Panel using an `.SFE` file with deprecated set names (for example, `pistonBearing:ID_front` rather than the current form `pistonFrontBearing`), then the reduction would fail with the following error:

```
ERROR 3 from FPBEST_CYL
Set not found: FACE_SET_pistonFrontBearing
```

This problem has been addressed such that Rapid now updates the `.SFE` file, either when the FE Model Panel is opened, or when an `.SFE` file is read from a new model.

MECH-11593	Crash on Linux Platform re-opening the Piston Solution or Ring Dynamics Solution Panels

Re-opening the Piston Solution or Ring Dynamics Solution Panels on the Linux Platform caused Rapid to crash. This problem has been addressed.

MECH-11630	Ring cutout dimensions are swapped in the `.rap` file.

MECH-10628

`.rap` file. This problem has been addressed.

MECH-11676	`accelerometer` sets are incorrectly added as constrained node sets

Any `accelerometer` set was incorrectly added to a given reduced model as a constrained node rather than as a node set. This problem has been addressed.

MECH-11711	`Add Matched Nodes Only` option fails to add sufficient reduced dofs and results in errors during assembly

For certain cylinder bore, bearing, skirt and land geometries that include cutouts or grooves the `Add Matched Nodes Only` option would fail to add sufficient nodes to the reduced model resulting in errors during assembly similar to:

```
Error in RMLCONROD_ASSEMBLY
Unable to find radial dof for connecting rod node    79248
```

This problem applied to all flexible components and has been addressed.

Note

This change may result in a slightly higher number of reduced model dofs when using the `Add Matched Nodes Only` option compared with previous releases.

MECH-11793	Changing the `.SFE` file referenced by a PISDYN Component has no effect

Changing the FE model `.SFE` file referenced by a PISDYN Component had no effect. The original `.SFE` file was still referenced unless the `Translate` button was selected by the user or the Output name was changed manually. This problem has been addressed.

4.2.4. RINGPAK

Major Enhancements	
MECH-10217	Enhanced End Gap Gas Dynamics

The RINGPAK End Gap Gas Dynamics model has been replaced by a model based on Y-Junction physics and which includes a coupled thermal solution. This new enhanced model is selected using Rapid as described by MECH-10750.

The model has been developed using 3-D VECTIS CFD simulations by verifying predicted gas flows, pressures and temperatures of the Y-Junction model with those of the CFD predictions.

The model gives much improved predictions of blow-by and 2nd land pressures when compared with available measurements, in particular for cases where the rings have cutouts and chamfers. This model is therefore recommended, rather than the previous 3-Way model which is retained for backwards compatibility only.

The Examples and Tutorials and have been updated to use this new model.

The following RINGPAK issues related to this change have also been resolved:

- MECH-10998
- MECH-11397
- MECH-11404

MECH-11443	Compression Ring with Chamfer Cutout

The compression ring now has the option of a chamfer cutout enabling for example a Keystone Ring with flats to be modelled correctly.

This option is selected using Rapid as described by MECH-11570.

MECH-11742	Support of Design of Experiments (DoE) studies

RINGPAK now supports the generation of multiple model files from a single parent file, enabling the solution of multiple cases for Design of Experiment studies.

This feature is invoked from the command line using the `-generate` switch as follows:

```
ringpak -generate [-output <file>] [-first <number>] <model file> <definition file>
```

where the multiple cases are defined in a separate `<definition file>`.

RINGPAK Tutorial 3 has been updated to use and demonstrate this new feature.

This relates to the following Issues:

- MECH-11715
- MECH-11735

Enhancements	
MECH-2022	Plots of hydrodynamic and boundary contact power loss and friction force for each ring

Enhancements

Plots showing the hydrodynamic and the boundary contact contribution of power loss and friction loss have been added to the `<case>.rp` output file as:

- `407: RING AXIAL HYDRODYNAMIC FRICTION FORCE`
- `408: RING AXIAL HYDRODYNAMIC POWER LOSS`
- `409: RING AXIAL BOUNDARY FRICTION FORCE`
- `410: RING AXIAL BOUNDARY POWER LOSS`

These are complimentary to the existing plots which show the total ring friction force and power loss:

- `403: RING FRICTION FORCE`
- `405: RING POWER LOSS`

To avoid confusion the names of the existing plots `Plot 403`, `Plot 404`, `Plot 405`, `Plot 406` have also been updated to emphasize that these plots relate to axial forces and losses only:

- `403: RING AXIAL FRICTION FORCE`
- `404: SUM OF AXIAL RING FRICTION FORCES`
- `405: RING AXIAL POWER LOSS`
- `406: SUM OF AXIAL RING POWER LOSSES`

MECH-10998	3D-Ready RINGPAK Solver now supports the End Gap Clearance plot

The 3D-Ready RINGPAK Solver now writes the intermediate end gap clearance which has been added as a plot to the `<case>.rp` output file as:

- `422: DIMENSIONLESS RING END GAP SIZE`

MECH-11397	Enhanced plots for Gas Dynamics

The piston crown, ring-pack and liner form a system of separated gas volumes. Six new plots have been added to the `<case>.rp` output file to show the sum of the gas flow rates and their equivalent areas:

- `361: LAND-GROOVE-LAND SUM OF GAS FLOWRATES`
- `362: LAND-LAND SUM OF GAS FLOWRATES`
- `363: EQUIVALENT AREAS ABOVE & BELOW RINGS`
- `364: LAND-GROOVE-LAND EQUIVALENT AREAS`
- `365: LAND-LAND EQUIVALENT AREAS`
- `370: GAS VELOCITIES AND TEMPERATURES IN GAPS`

In addition the plot:

- `311: GAS FLOWRATE COMPONENTS FOR LANDS & GROOVES`

has been renumbered as:

- `310: GAS FLOWRATE COMPONENTS FOR LANDS & GROOVES`

MECH-11735	RINGPAK supports Run Distribution Manager (RDM) heartbeat

Enhancements

RINGPAK has been updated to support the RDM heatbeat introduced in this release, allowing an RDM job to be shutdown in a controlled manner thereby releasing all licences used by that RDM job.

To facilitate this change the following command line options have been added:

`-noheartbeat`	Disable the heartbeat	
`-timeout`	The allowable period of time in secs that RDM can be disconnected from the network	[Default = 5 secs]
`-missed_beats`	The number of heartbeats that are missed after which the RDM job is stopped	[Default = 1]

This also relates to MECH-11551.

Corrections

MECH-11342	The plotted extent of the Gap Radial Distance in the Gap Profile plots is incorrect

The extent of the Gap Radial Distance in the Gap Profile plots `Plot 51:`, `Plot 52:`, etc was plotted using the wrong units and was a 1000 times to small. This problem has been addressed.

MECH-11404	Gas flow areas of Oil Control Ring (OCR) are wrong for 3D-Ready RINGPAK Solver

The open and closed states of the OCR side clearances were ignored when calculating the gas flow areas for *Above Ends* and *Below Ends*. The clearances were treated as open all the time. This problem has been addressed, and may lead to slightly different predictions of blow-by.

4.2.5. Ringvis

There are no changes to Ringvis in this release.

4.3. SABR

This note announces the release of SABR and SABR-Gear version 2018.1. This supersedes the previous release, which was SABR and SABR-Gear 2017.1.

SABR is a shaft, gear, and bearing concepting and design package, developed to integrate into the design process and reduce product development time.

This version of SABR is available for 64-bit Windows (win64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

4.3.1. SABR

Major Enhancements	
MECH-11736	Enhanced visualisation of data

The following enhancements have been introduced to aid visualisation of data using SABR:

- Shaft and gear displacements can now be viewed in 3D.
- The 3D display of built-in gears (including planets) has been improved in cases where the root diameter of the gear is smaller than the outer diameter of the supporting shaft.
- In 3D views helical gear teeth now appear to follow a helix rather than being drawn as a straight line.
- Extra views have been added to help visualise gear misalignment.
- Each shaft can now be assigned a unique colour in each 3D view, thereby helping to understand the structure of complex models.
- The drive and coast flanks of gear meshes can now be marked in some of the 3D views.

Enhancements	
MECH-11753	Lubrication details now include effective kappa

In the lubrication calculation of life modification factor, the effective viscosity ratio (kappa) can be modified by the presence of EP additives in the lubricant. The Details pop-up on the Lubrication tab now displays both the basic value of kappa and the effective value. The calculation has not changed - this is just to help the user understand how the life modification value has been arrived at.

MECH-11756	Improved response for models with Synchronisers

The responsiveness of the SABR user interface has been improved in several places, particularly for models that include synchronisers.

MECH-11782	Cross-region import of duty cycle `csv` files is now supported

It is now easier to import a duty cycle table `csv` file produced in a region with different list and decimal separators.

Corrections	
MECH-9935	Modified bearing profile is not saved to the local bearing catalogue

If a roller bearing with a modified profile was saved to the local bearing catalogue, it was not retrieved properly in subsequent SABR sessions. This problem has been addressed.

MECH-11165	Various problems with Synchronisers

Several errors related to the synchroniser facilities have been addressed.

MECH-11318	3D display freezes when displaying epicyclics

The 3D display would occasionally freeze when displaying epicyclics. This problem has been addressed.

MECH-11362	SABR Icons are missing in a standalone installation of SABR

The icons in the Start Up menu were missing if SABR was installed without any other Ricardo Software products. This problem was introduced in 2017.1 and has been addressed.

MECH-11386	Spur gears still use helix angle for reference diameter etc when they shouldn't

Corrections	
Spur gears were using the helix angle for reference diameter etc when they shouldn't. This problem has been addressed, such that if the helix angle field is set to a non-zero value for a gear marked as a spur gear, SABR now uses zero in formulae that depend on the helix angle.	
MECH-11409	Changing EP additive has no affect on the results
In order to address problems with updating lubricants the following modifications have been made: • The Lubricant editor now has an 'Update Results' button for use after changing the properties of a custom lubricant. • Loading a new file now correctly removes traces of custom lubricants from the previous model.	
MECH-11420	Crash solving a model with a disabled Casing Model
The SABR solver would crash intermittently (with a yellow screen) when solving a model with the Casing Model disabled. This problem has been addressed.	
MECH-11436	Non-powered load cases are being displayed when they shouldn't be
In the Misalignments tab, the calculation for a mesh should only be shown for load cases in which the mesh is powered. Some non-powered load cases were being displayed due to rounding errors within the torque calculation. This problem has been addressed.	
MECH-11590	LOAMA calculation is wrong for some planet meshes
The misalignment calculation was wrong for some complex epicyclic planet meshes. This problem has been addressed.	
MECH-11597	All synchros are displayed even when 'Shaft Only' is selected
The 3D display would display all synchros when 'Shaft Only' was selected. This problem has been addressed, such that synchros now appear in 3D diagrams only when appropriate.	
MECH-11673	Creating a new custom Lubricant changes displayed bearing lives
Creating a new custom Lubricant changed the results displayed on the Bearing Life tab. This problem has been addressed.	
MECH-11733	Incomplete `GBX` file will not load
If a file is accidentally saved with a bearing that has no geometry specified, SABR will now load that file with no problems, attaching a default geometry to the bearing.	
MECH-11745	Crash with no duty cycle defined
Previously, a model with no duty cycle defined could cause SABR to throw an exception when displaying one of the results tabs. This problem has been addressed.	
MECH-11751	Wrong input shaft in DCT reflected inertia calculation
SABR now calculates the correct reflected inertia in dual-clutch transmission models.	
MECH-11781	Gear update function ignores pressure angle and helix angle
If you update an NGR file using a SABR geometry that has different pressure or helix angles, the SABR values are now correctly copied into the new file.	
MECH-11784	Helix angle in 3d geometry export is wrong
When exporting 3D gear geometry to STL, the helix angle is now calculated correctly.	
MECH-11830	SABR ignores custom format preferences in `CSV` files

Corrections
When writing and reading `CSV` files, SABR now respects any custom modifications to Windows formatting preferences, i.e. those made using the *Additional settings...* button.

4.3.2. SABR Gear

Enhancements	
MECH-11562	Gear misalignment is now editable
The *SABR Misalignments* fields on the Misalignment tab are now editable.	
MECH-11785	Export of gear tooth surface geometry to Abaqus
GEAR can now export gear tooth surface geometry in Abaqus `.inp` format.	
MECH-11787	Gear efficiency
Estimates of gear losses have been added based on ISO/TR 14179-1 and ISO/TR 14179-2 which include calculations for gear friction and churning losses.	

Corrections	
MECH-10955	GEAR crashes on file load if ISO tab is showing
GEAR no longer crashes when the ISO tab is showing, *Use default ISO factor KA* is set to *YES*, and a file is loaded.	

4.4. VALDYN

This note announces the release of VALDYN version 2018.1. This supersedes the previous release, which was VALDYN 2017.1.

VALDYN is a multi-body dynamic and kinematic simulation tool specifically developed for powertrain system analysis. Users are advised to refer to the VALDYN product manual for usage instructions.

This version of VALDYN is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

- VALDYN
- VALDYN Kinematics

Related release notes include:

- FEARCE
- FE Translators
- Material Editor
- Matutil
- R-Desk
- RPlot
- Run Distribution Manager
- SDFBrowser

4.4.1. VALDYN

Deprecated features:

- FEARCE Include file (MECH-11618)

Major Enhancements	
MECH-10148	Enhanced Swinging Follower Object

A new enhanced Swinging Follower VRFOLLOWER_V2 object is now available that includes a dynamic body integrated within the swinging follower. This offers a number of advantages over the existing VRFOLLOWER object including :

- The modes of the follower, derived from the supplied FE model, are included in the VALDYN solution
- For pad followers the contact between the follower, cam and valve tip are modelled using flexible lamina
- The need to calculate equivalent stiffness' and masses from a static FE analysis is no longer required

As part of this change the following elements have been added

- DB_CAM_PAD_CONTACT
- DB_CYL_FLAT_ARMTIP

and FEARCE has been updated to support the backsubstitution of results from the VRFOLLOWER_V2 object as per FEARCE-5660.

MECH-11009	2D Visualisation of ROCKER and PUSHROD objects

The ROCKER and Rocker Geometry Properties (ROGEOM) Panels now have a `View Geometry` button to enable rapid verification of the intended geometry showing the rocker and any connected PUSHROD Object.

This relates to

MECH-10218

MECH-10827

Enhancements

MECH-11122 Run-time loading of LAPACK and Intel® MKL libraries in VALDYN

As with the other Mechanical Suite solvers, the VALDYN solver now loads LAPACK and Intel® MKL libraries on run-time depending on the number of processors, as given by the `-np` command line switch, such that:

- `-np=1` the LAPACK library is used (Default).
- `-np=N` where N > 1, the MKL library is loaded.

The former improves the solution consistency over platforms and different CPUs, whilst the latter provides optimized functions which may provide improved solution efficiency.

This change also means that the default library is now LAPACK rather than MKL and as such slightly different results may be observed.

Related to this change is MECH-11385.

MECH-11332 Additional DYNAMICBODY error message to assist with diagnostics

DYNAMICBODY objects now report an error when the associated generalized mass matrix fails to be positive definite. The error message indicates the first mode number at which this fundamental property is violated. The error message is of the form:

```
**ERROR** 1 from DB_ACCELERATION
Generalized mass matrix of DYNAMICBODY "DYNAMIC_BODY_1" is not positive definite.
Check elastic mode          113
Corresponding to FEA mode   119
```

MECH-11385 Update of libraries supplied in a VALDYN FMU

As a consequence of MECH-11122 a VALDYN FMU will now be supplied with a LAPACK shared library rather than Intel® MKL libraries.

Also as part of this change a FMU is now supplied with other libraries which were missing in previous versions including Ricardo checksumlib and Intel® run-time libraries.

MECH-11401 Non-circular PULLEY can now be defined using geometry of the whole pulley

It is now possible to define a non-circular toothed PULLEY using geometry of the whole pulley rather than for a single tooth. This is intended to allow the user to define the whole pulley using scanned geometry which may be more convenient.

MECH-11550 VALDYN supports Run Distribution Manager (RDM) heartbeat

VALDYN has been updated to support the RDM heatbeat introduced in this release, allowing an RDM job to be shutdown in a controlled manner thereby releasing all licences used by that RDM job.

MECH-11910 Body loads are no longer written for a VALDYN DYNAMICBODY

The body loads previously written to the reduction `.FRC` file are no longer written since these were not used by the VALDYN solver.

Corrections

MECH-11504 VALDYN crashes using replot

VALDYN crashed performing a replot on models that included a GEARSET Object which had `CASEPLOT` or `SUMPLOT` plots based on `GEARSET.TK` or `GEARSET.FT2` outputs. This problem has been addressed.

MECH-11526 GEAR3D `Slices over face width` value is not updated as expected

Corrections	
VALDYN 2017.1 introduced a bug in the GEAR3D Object such that the value of `Slices over face width` was not being stored correctly. This problem has been addressed.	
MECH-11615	Unexpected jump in simulation angle
The simulation angle jumped unexpectedly, from say 56 deg to 28 deg. This problem would occur for any model that included a GENSPRING object and which used the variable `GENSPRING.SAFACvSEG` in any Expression or `CASEPLOT`. The use of this variable caused the simulation angle to be corrupted and resulted in the observed behaviour. This problem has been addressed.	
MECH-11728	DYNAMICBODY fails for non-trivial initial angle
Any model with a DYNAMICBODY object would fail if any one of the DYNAMICBODY initial angles was non-zero. Forces and torques from the connection MASSes were mapped incorrectly onto the FE reduced model which most likely would result in non-convergence. This problem has been addressed. Moreover, in such cases any non-trivial initial translational velocity was mapped incorrectly to the FE model, which could result in spurious transient oscillations and delayed convergence of the DYNAMICBODY results. This problem has also been addressed.	
MECH-11763	2D visualisation of the VRGEOM Object fails if the OILFILM Property is included
The 2D visualisation of the VRGEOM Object using the `View Geometry` button failed if the Cam-Follower Friction Type was set to OILFILM. This problem has been addressed. This relates to MECH-10218	
MECH-11776	DYNAMIC_BODY constrained node is in the wrong position
The VALDYN GUI failed to update the position of the constrained node when re-defining the Constrained Node Set to use a different face set. This problem has been addressed.	
MECH-11793	Changing the `.SFE` file referenced by a DYNAMIC_BODY Object has no effect
Changing the FE model `.SFE` file referenced by a DYNAMIC_BODY Object had no effect. The original `.SFE` file was still referenced unless the `Translate` button was selected by the user or the Output name was changed manually. This problem has been addressed.	
MECH-11806	Incorrect DYNAMICBODY results when initial conditions are relative to a reduced node
If the initial conditions for a DYNAMICBODY were entered relative to one of the connected MASS elements, the velocities of the MASSes connected to this DYNAMICBODY would be calculated incorrectly. The error was proportional to the coordinates of the corresponding reduced node in the FE model and could eventually lead to failure of the simulation. This problem has been addressed.	
MECH-11933	NODE data in the mouse tooltip is wrong after editing FE properties of a DYNAMICBODY
The NODE data displayed in the mouse tooltip was wrong having edited the FE properties of a DYNAMICBODY and at the same using the Position Pop-up Panel. This problem has been addressed.	
MECH-11957	Incorrect GENSPRING stress outputs
If a model contained more than one GENSPRINGGEOM, then there could have been a problem when computing then stresses. This problem has been addressed.	

Documentation	
MECH-11483	Updated BELT_V2 and CHAIN_V2 documentation related to `FLAP` output
The documentation related to the flap (`FLAP`) output has been updated to clarify the sign convention for belt and chain flap.	
MECH-11698	Updated CHAIN_V2 documentation related to `PF`, `PFA` and `PFN` outputs
The documentation related to Pivot Force (`PF`), Axial Pivot Force (`PFA`) and Normal Pivot Force (`PFN`) has been updated to better explain these output data.	

Deprecated Features	
MECH-11618	The Include option has been removed from the VALDYN Matrix Reduction Panel
The Include option which allowed a FEARCE `.FRC` file to be included in the reduction `.FRC` file written by the Matrix Reduction Panel has been removed. VALDYN is now consistent with ENGDYN and PISDYN where this feature was removed in a previous release for these products.	

4.4.2. VALDYN Kinematics

Major Enhancements	
MECH-11512	Updated Generated Cam Profile Output

So as to help avoid confusion when interpreting the cutter output file the GENERATED_CPROFILE element has been enhanced to generate two additional files:

```
<cutterOutput.txt>.blade
<cutterOutput.txt).cut
```

The cutter output as written to these files is set to a Reference that either corresponds to the *Peak cam lift*, or to the *Start of cam Profile* where the latter requires a Cam datum and a Feature name.

This feature is available in both the Legacy VALKIN GUI and the VALKIN-Kinematics plugin within R-Desk.

This relates to:

- MECH-11678
- MECH-11813

Enhancements	
MECH-11813	Distortion Angle is now written to the `.out` file for Swinging Follower element

The eccentricity of the cam causes significant variation in rocker ratio for a swinging follower so that the cam angle intervals cannot be compared directly to the crank angle intervals. The roller or pad of the swinging follower not only lifts, but also rotates about the cam by a angle known as the Distortion Angle. This angle is now written to the solution `.out` file.

Corrections	
MECH-11663	Unable to run the VALKIN solver if the `.sdf` results file is open by another application

It was not possible to run the VALKIN solver if the `.sdf` results file was open by another application such as SDFBrowser. This problem has been addressed such that the VALKIN solver now behaves in the same way as the VALDYN solver.

MECH-11724	VALKIN solver reports sdf errors and ends with an error code

If a model included Rigid Body Output Geometry with spaces in its name the VALKIN solver would fail with sdf errors of the form:

```
**ERROR** 3060 from sdf_set_opts
Unknown option "".
```

This problem has been addressed.

Documentation	
MECH-11678	Updated Swinging Follower Design Guideline

This section has been updated to more clearly describe the Distortion Angle and now includes a number of examples to assist the user.

This relates to:

- MECH-11813

4.5. Utilities

- matutil

4.5.1. matutil

There are no changes to matutil in this release.

5. VECTIS

This note announces the release of the 2018.1 version of VECTIS. This supersedes the previous release, which was VECTIS 2017.1.

VECTIS is a 3D CFD tool specifically developed for automotive and IC engine applications. Users are advised to refer to the VECTIS product manuals for usage instructions.

This version of VECTIS is available for lnx_x23.64 and win64 platforms. Please see the Platform Policy for specific details.

The release notes have been separated into the following sections:

Related release notes include:

- FE Translators
- R-Desk
- RPlot
- SDFBrowser

5.1. VECTIS GUIs

Corrections	
VECTIS-7183	Display of subscripts in table headers
Subscripts in table headers were not shown correctly. This has been fixed.	

5.2. VECTIS Pre-processing

Corrections	
VECTIS-6960	VMESH assigns a wrong face to a cell
Under very complex and rare circumstances it could happen in boxes where more than two volumes were present that one of them has been assigned the wrong face. This error leaded to generation of two incorrectly formed cells (one was missing a face, the other owned one more face), which decreased quality of the generated mesh in versions 2016.2 and 2017.1. It has been fixed in the current release.	

5.3. VECTIS PHASE5

Related R-Desk Viewer corrections:

- Flood picking (R3D-745)

Enhancements	
VECTIS-7176	Improved robustness of CPV3 model
Two changes have been made to improve the stability of CPV3 simulations. The value of the threshold limit for the gas constant (Rg = Runiversal/ Mweight) of the mixture returned from CPV has been increased. The previous threshold limit could stop simulations with correct physical values. Now the limit only stops simulations with non-physical values. Temperatures returned from CPV table are now all clipped to a minimum value of 250 K. This clipping was already being made but for other mixtures (burnt mixtures). The clipping is now also made for purely fresh gases, which happen to have a very low enthalpy.	

Corrections	
VECTIS-7038	User wall function is passed an incorrect patch index
The patch number passed from the wall function user functions did not match the patch number that would be extracted from the standard patch user functions. This has been fixed	
VECTIS-7079	Multi-fuel simulation creates incorrect species with wall impingement
In multi-fuel simulations with wall film, the evaporated fuel mass from wall film was incorrectly distributed between the gas flow species for cases where some of the fuels had zero concentration in the wall film liquid mixture. This led to an incorrect composition of the gas flow in near-wall regions.	

5.4. VECTIS VSOLVE

Corrections	
VECTIS-7097	Sliding sub-domain cannot be combined with other sub-domain models
In simulations using the sliding grid method, a problem with the weak AGI (JTYPE=1) procedure led to incorrect interfaces being produced on other non-rotating subdomains. This problem has now been fixed.	
VECTIS-7159	Rotation rate of a stationary boundary inherited incorrectly from sub-domain
The boundary face volume flux was incorrectly set for non-rotating walls belonging to rotating sub-domains. It is now set to zero for absolute velocity formulation and a negative sign is assigned when relative velocity formulation is used. This fix can result in small differences in main field quantities in a simulation.	

5.5. VECTIS Tools

There are no changes to the VECTIS Tools in this release.

5.6. VECTIS Documentation

There are no changes to the VECTIS Documentation in this release.

6. WAVE

This note announces the release of WAVE version 2018.1. This supersedes the previous release, which was WAVE 2017.1.

WAVE is a gas dynamics software used to analyse the pressure waves, mass flows, and energy losses in ducts, plenums, and the manifolds of engine systems and machines. Users are advised to refer to the WAVE documentation for usage instructions.

This version of WAVE is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

> **Note**
>
> The 64-bit installation supports building of 32-bit binaries for use in Simulink and FMUs. On Windows this covers both WAVE-RT and R-CAT. On Linux it covers WAVE-RT only.

WAVE GUI programs may be started from the Programs menu on Windows platforms and all programs may be started by typing the program name at a command prompt. The user manual is available from the Help menu in the GUI programs, from the Start menu on Windows platforms, and as a PDF in `Docs/Manuals` in the Ricardo installation.

These release notes are separated into the following sections:

Other related release notes include:

6.1. WAVE

There are no changes to WAVE in this release.

6.2. WAVE-RT

Corrections	
WAVE-11906	Support SDK 7.1 compiler for WAVE-RT and FMU compilation

The toolchain for creating WAVE-RT FMUs has been updated to work with the Windows SDK 7.1 compilers. It works in both WaveBuild and R-Desk.

Note that the SDK is only useful for Windows 7 users. Windows 8 and Windows 10 users will need to install Visual Studio 2012 Express or 2013 Express (2012 is recommended for compiler speed) since Microsoft has removed the compilers from SDK 8 and SDK 10.

6.3. WaveBuild

Corrections	
WAVE-12008	Command line distribution fails if model has network component
Using the `-dist` command line option would fail with the error “You do not have a license to edit components of type Network” if the model contained a network component. This error has existed for several releases. It has now been corrected.	

6.4. WaveBuild3D

Major Enhancements	
WAVE-9631	Create tubes from cross sections
The skinning tool can now make tubes from cross sections. The cross sections can be made directly in the skinning tool, or they may be imported from a .csv file created by WaveMesher's duct profile tool. This allows the user to quickly make tubes from native CAD geometry and from STL meshes. There are new tutorials showing how to use the feature.	
WAVE-10046	Join and divide tubes
Two separate tubes may joined to make a single tube, and a single tube may be divided at a section connector to make two separate tubes. To assist the joining operation, a tube's direction may also be swapped (which moves the origin to the other end).	

Enhancements	
WAVE-11953	Cavities with absorptive materials now painted green
Previously a cavity containing absorptive material was painted a browner shade of the base cavity colour. This was not always easy to differentiate from the unpacked colour. Such cavities are now painted green (or orange if the base colour is a shade of green) in order to be more obvious.	

6.5. WaveMesher

Corrections	
WAVE-11982	Swapped duct ends are ignored
If the direction of a duct was swapped in the WaveMesher geometry, the left and right diameters were not correctly written into the duct in the component's mesh. This could easily be seen if the component was merged to the WaveBuild canvas and any tapered ducts visualized with the Scale View tool. This has now been corrected.	

6.6. WAVE Plugin

Enhancements	
WAVE-11977	Fix structural conduction for GT-Power V2016, V2017
The GT-Power importer has been enhanced to read structural conduction data in GT-Power versions 2016 and 2017. Previously it only read version 7.5 files.	
WAVE-11978	Import sub-assemblies from GT-Power
The GT-Power importer imports sub-assemblies as sub-models. This is a beta feature in this release; some of the connections to the parent may need to be fixed after import, and some of the elements may be oddly positioned.	

6.7. Examples and Tutorials

New	
WAVE-9631	Importing CAD tutorial
New tutorial in Intermediate > WaveBuild3D showing how to import both volumes and tubes from CAD geometry. The tutorial demonstrates how to extract cross sections from CAD and use them in the WaveBuild3D CAD Importer to construct volumes and tubes. It shows the process for both STL geometry and native CAD data.	
WAVE-10046	Advanced duct operations tutorial
New tutorial in Intermediate > WaveBuild3D showing how to use the new feature for joining and dividing tubes.	

7. Utilities

7.1. ISIS

This note announces the release of ISIS version 2018.1 which supersedes the previous release 2017.1.

ISIS is a collection of utilities to enhance the usage of Ricardo Software products, including a server program (ISISD) which allows queuing on a Windows or Linux computer and a command line program (ISISQ) which submits jobs to the server.

This version of ISIS is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

There are no changes to ISIS in this release.

7.2. Material Editor

This note announces the release of the Material Editor version 2018.1 which supersedes the previous release 2017.1.

The Material Editor is a graphical tool used by FEARCE and the Mechanical Suite of products for viewing and editing material property data.

This version of the Material Editor is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

There are no changes to Material Editor in this release.

7.3. RPlot

This note announces the release of RPlot version 2018.1 which supersedes the previous release 2017.1.

RPlot is a generic graph plotting tool usable for all Ricardo Software products. Users are advised to refer to the RPlot Help System for usage instructions.

This version of RPlot is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

There are no changes to RPlot in this release.

7.4. Run Distribution Manager

This note announces the release of the Run Distribution Manager (RDM) version 2018.1 which supersedes the previous release 2017.1.

RDM is a facility to solve several models in parallel either locally or on a computational cluster, while sharing only one solver license throughout the whole simulation. This facility is available for use with IGNITE, PISDYN, RINGPAK, VALDYN and WAVE.

This version of RDM is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

Major Enhancements	
RMODEL-799	Run Distribution Manager (RDM) now has a heartbeat

RDM now has a heartbeat allowing an RDM job to be shutdown in a controlled manner thereby releasing all licences used by that RDM job. An RDM job will shutdown if the network connection is lost, or by user-control using Job Monitor or rdmclient.

The heartbeat is enabled by each application and has 2 inputs:

- Timeout period [Default = 5 secs]
- Number of missed heartbeats [Default = 1]

which are used by RDM to determine a lost network connection.

An RDM job can be shutdown by a user either using Job Monitor using the 

button, or using a new command line program called rdmclient.

rdmclient enables the user to list or stop jobs where

```
rdmclient list -statusdir ~/test_status/
rdmclient list
```

will list the current RDM jobs, where the latter will list directories that match an auto-detected format, and

```
rdmclient stop -statusdir ~/test_status -uid 42f0f13b553762e243abe720c9c53aa876e2973a
```

will stop the specified job.

Note

In this release IGNITE, PISDYN, RINGPAK and VALDYN have been enabled to use the RDM heartbeat.

7.5. SDFBrowser

This note announces the release of SDFBrowser version 2018.1 which supersedes the previous release 2017.1.

SDFBrowser is the Graphical User Interface for viewing data stored within Ricardo Software SDF files. Along with the GUI, SDFBrowser is shipped with various command line programs to view and extract data from SDF files. Users are advised to refer to the SDFBrowser Help System for usage instructions.

This version of SDFBrowser is available for 64-bit Windows (win64) and Linux (lnx_x23.64). Please see the Platform Policy for specific details.

These release notes are separated into the following sections:

7.5.1. SDFBrowser

There are no changes to SDFBrowser in this release.

7.5.2. sdfcmp

Corrections	
UTILS-1610	sdfcmp output is incorrect from character arrays
Sometimes the output would include random characters beyond the actual values in a character array and as a consequence incorrectly flag a difference. This problem has been addressed.	

7.5.3. SDF Library

Corrections	
UTILS-1689	Environment variable `SDF_LOCK_LIFE_HRS` set to `0` ignores `.lock.lock` file
Setting `SDF_LOCK_LIFE_HRS = 0` failed to delete the `.lock.lock` file as expected. This problem has been addressed such that the `.lock.lock` file is now deleted in the same way as the `.lock` file.	

8. Ricardo License Manager and Tools

This note describes changes to the Ricardo License Manager and its supporting tools for the 2018.1 version of the Ricardo Software suite. In this release the Ricardo License Manager version is 11.13, which corresponds to the FlexNet version being used.

The Ricardo License Manager controls the execution of all licensed Ricardo Software products.

The Ricardo License Manager is typically installed on a server machine to provide licenses to a number of users. See the installation and license administration documentation in `Ricardo/licmgr/docs`.

There are no changes to the Ricardo License Manager in this release.