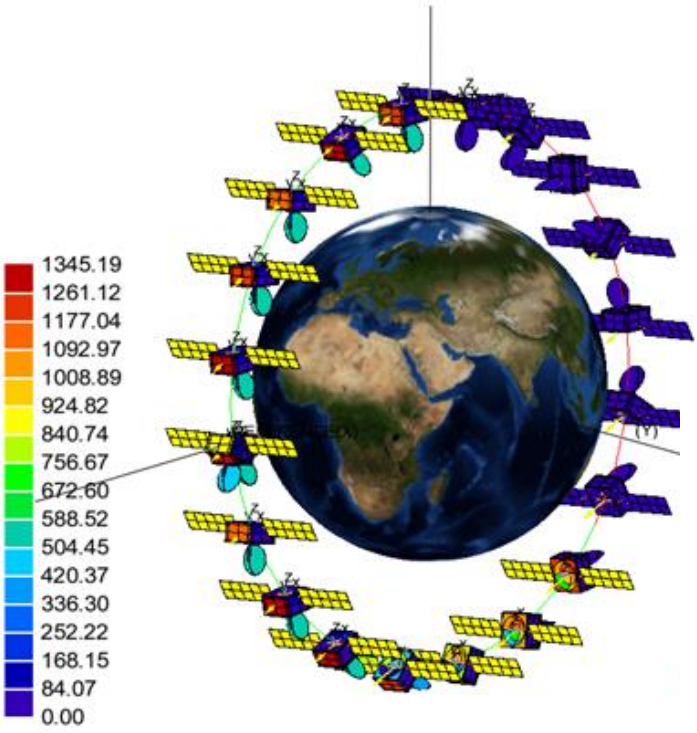
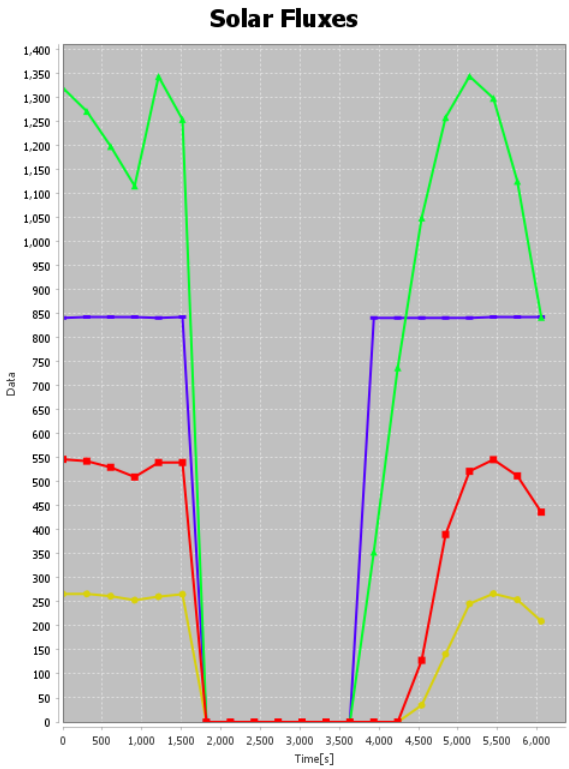
ESATAN-TMS

Release Notes





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1 Introduction

ESATAN-TMS 2020 is another major evolution of the product, providing new functionality that significantly enhances the thermal modelling capability of Workbench. A key development is building on the ability to assign variables to all real, integer and point parameters. Variables defined in Workbench can now be automatically exported to the analysis file and defined as user constants. Improving and simplifying the parametrisation of the thermal analysis model.

ESATAN-TMS 2020 brings a new level of flexibility for building the geometrical and thermal model by allowing the definition of properties at individual face or volume level

Along with charting of model and thermal result data, ESATAN-TMS 2020 provides the ability to post-process the radiative heat fluxes results directly from the radiative case, making the post-processing functionality in ESATAN-TMS even more powerful.

Included in the release are a number of general extensions to the software, which includes both optimisation of the thermal solvers and improved mechanism to post-process user constants defined in the thermal analysis model. In addition, a large number of open issues have been resolved with this release.

The following sections describe in detail the changes introduced within ESATAN-TMS 2020 release.

- **Definition of Properties of Faces and Volumes**

  ESATAN-TMS 2020 extends the modelling capability by providing the ability to set the properties of individual faces and volumes. This both enhances the efficiency of creating a model and extends the modelling capability – addressing user requests, such as controlling the thermal node number of selected faces and setting the activity of faces to model a 5-sided box.

  <*more detail*>

- **Custom Cavities and Cavities Defined by Face**

  ESATAN-TMS 2020 allows cavities to be defined from a face rather than a surface, adding faces that can see each other to the cavity rather than complete surfaces. In addition users can custom build a cavity or modify a generated cavity.

  <*more detail*>

- **Remove Shell Face**

  A request from a number of customers is to be able to directly remove selected shell faces of a shell, rather than having to define cutting geometry. ESATAN-TMS 2020 provides a simple

mechanism to select and remove one or more shell faces. The removed faces can be easily restored.

<*more detail*>

- **Export of Variables to Analysis File**

  ESATAN-TMS allows a fully parameterised model to be defined, allowing a clear and maintainable model to be defined. ESATAN-TMS 2020 extends the capability further, by providing the ability to retain references to parameters within the generated thermal model. This facilitates performing parametric analysis or sensitivity studies.

  <*more detail*>

- **Charting of Radiative Case Heat Fluxes**

  The product vision is that Workbench provides a complete and effective thermal modelling environment, and ESATAN-TMS 2020 extends the charting capability to allow the user to post-process environment heat fluxes, calculated by the radiative analysis, using charts – line charts, delta charts and limits charts.

  <*more detail*>

- **General Improvements**

  Extended selection: The ability to add data to a chart by selecting geometry within the visualisation has been extended within ESATAN-TMS 2020.

  <*more detail*>

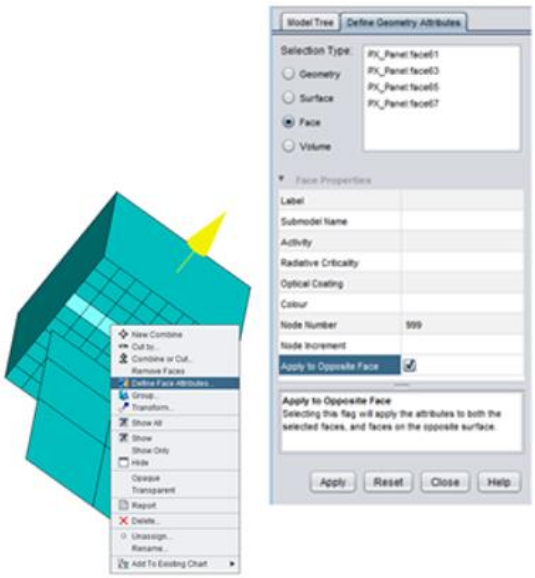
  Chart ESATAN-TMS Thermal User Constants: User constants are defined within the thermal model, both directly by the user and automatically by Workbench, representing key data such as thermostat parameters. ESATAN-TMS 2020 allows User Constants to be post-processed using charts.

  <*more detail*>

2 Developments

Definition of Properties of Faces & Volumes

Over the past few years, there has been a significant number of modelling scenarios raised by customers where geometry or material properties need to be defined at the face and volume level, rather than at the surface level. For example, setting a face of a box inactive to model a 5-sided box or controlling the thermal node numbers on specific faces. ESATAN-TMS 2020 allows the properties of individual faces and volumes to be selected and re-defined. The geometry is defined in the normal way, setting global parameters, and then the new Define Geometry Attributes dialog is used to redefine properties of selected geometry, surfaces, faces or volumes. If a point in the hierarchy is redefined (an assembly, cut or combination) then the changes are applied recursively from the selected point down to each primitive geometry.



Cavities

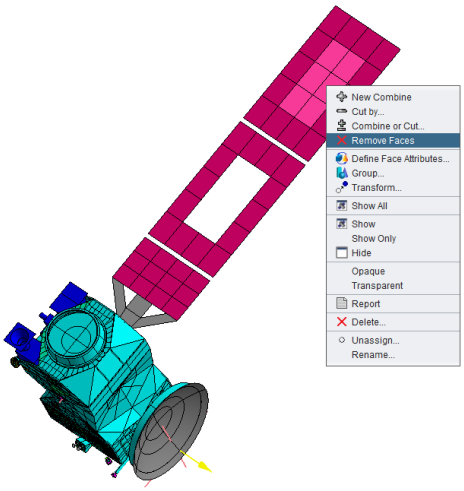
To date, cavities have been defined by selecting a surface and allowing ESATAN-TMS to identify all other surfaces that can see, directly or indirectly, that initial surface. ESATAN-TMS 2020 introduces greater granularity by allowing an initial face to be selected and then generating the cavity as all faces that can see, directly or indirectly, that initial face. In addition, it is now possible to define a cavity as an arbitrary list of faces, surfaces, geometries and/or groups, and also to custom modify a generated cavity by adding or removing faces/surfaces. Finally, a cavity can be defined as external, in which case it will consist of all faces that can see, directly or indirectly, the environment.

When a cavity is generated from a (sur)face we fire rays from that (sur)face to identify connected (sur)faces, and then recursively from those (sur)faces. To date we have always fired 100 rays from each (sur)face, but we have now made the number of rays user-specifiable with a default of 100.

As a consequence of these changes, a single face or surface can now belong to more than one cavity. It is the user's responsibility to ensure that any analysis case consists of (sur)faces that only belong to one included cavity.

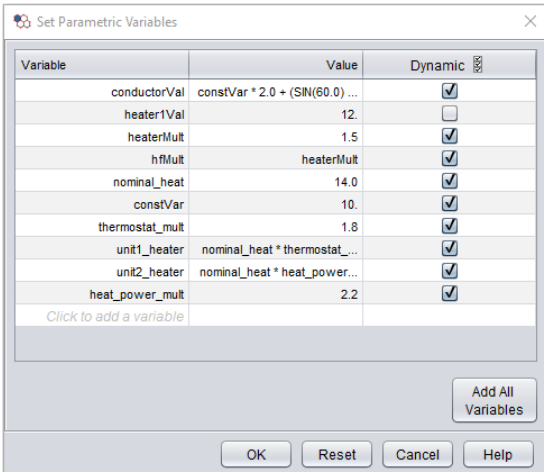
Remove Shell Faces

A powerful feature of ESATAN-TMS is to be able generate complex geometry through the use of cutting operations. To simplify the process, ESATAN-TMS 2020 provides the capability of directly removing shell faces, avoiding the process of defining cutting geometry. Individual shell faces are selected and the menu option "Remove Faces" used to remove the faces, effectively creating a hole. Faces can be easily restored by selecting the geometry and restoring all the faces on the selected geometry. Both the removal and restoring of faces is supported through the language, with the ability to restore individual faces supported by the language.



Export of Variables to Analysis File

A powerful new feature within ESATAN-TMS 2019 was the ability to assign any Workbench real or integer parameters to a variable or an expression involving one or more variables. The parameter is immediately updated if any of the variables are modified. This allowed the creation of a fully parametrised model, making the model much more readable and amenable to future changes. ESATAN-TMS 2020 provides the next step, allowing the user to select which variables to export to the ESATAN-TMS Thermal analysis file. By retaining references to variables within the analysis file, a parametrised thermal model is generated, allowing the user to access and control the variables during the thermal solution. Parametric analysis can be performed, running the thermal model with different variables sets.



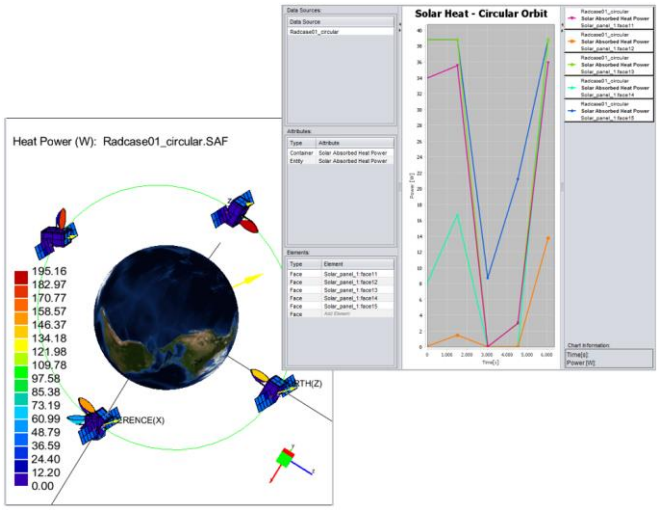
The thermal results can then be post-processed within Workbench using charts, for example, plotting results on a Delta Chart, comparing results from sensitivity analysis.

ESATAN-TMS 2020 also extends the ability to scale radiative heat fluxes. A scale factor can be applied to the

calculated radiative heat fluxes for selected geometry, and different scale factors can be defined for different heat flux types – or combination of heat flux types (solar, albedo, planet and emitter heat fluxes). Multiple scale factors can be defined. The scaled heat flux is applied within the ESATAN-TMS Thermal analysis file. Note that the scale factor itself could be a variable and the variable exported to the analysis file.

Charting of Radiative Case Heat Fluxes

ESATAN-TMS 2020 extends the charting capability to allow charting of radiative heat fluxes, solar, planet, albedo and emitter heat fluxes. As soon as the radiative analysis is performed, one or more radiative results can be selected and an Attribute, Delta or Limits Chart created to display the results – charted against orbit time. Similar to existing charts, multiple faces or containers of faces can be plotted on a chart. When charting radiative data, a container is any entity that contains multiple faces, this can be a group, a surface or a primitive geometry. This allows radiative result data to be both visualised on the geometry (at a single orbit position or all orbit positions) or/and on a chart. The image below shows the display of absorbed solar power both as an orbital display on the geometry and as a graph.



General Improvements

Extended selection

The option to select data within the visualisation to add to a chart has been extended within ESATAN-TMS 2020. The user can now select geometry within the visualisation to add geometry, groups and thermal submodels to a chart. If there are multiple groups or thermal submodels defined for the selected geometry, a select list will be displayed.

Chart ESATAN-TMS Thermal User Constants

Workbench exports variables to ESATAN-TMS Thermal as User Constants; these can be user-defined variables, or automatically created variables; for example, User Constants are generated for thermostatically controlled Boundary Conditions. ESATAN-TMS 2020 provides the facility to store User Constants during the thermal solution, and then charts can be created within Workbench to post-process the data, following the same approach as other chart data. By setting the chart element type as variable, all the available ESATAN-TMS Thermal User & Controls constants for the selected data source are presented.

3 Problems Fixed

CADbench

1. CADbench 2019 installer accessing internet to install the re-distributable files.

Workbench

1 ESATAN-TMS fails to generate an analysis file, where shells have been defined using a shell vector, and through conductors are generated.

2 The description field of a bulk or optical property is cleared when a name is entered.

3 Variables can be defined multiple times within the Analysis Case Set Parametric Values dialog, and no error is given - the dialog drop-down list contains variables that have already been added to the Analysis Case.

4 For models for which Conductive Interfaces have been created and then deleted, Workbench can fail when saving a model using Save As.

5 An error is sometimes generated if geometry is created with a non-regular mesh, where the mesh positions have not be defined.

6 Workbench can fail if the Display Data dialog is open when another dialog is launched.

7 Workbench generates opticals with deprecated parameters when the optical property is angle-dependent.

8 If a variable is used to define an attribute (e.g. Geometry transformations), if the variable is defined as 0.0, the attribute is no longer bound to the variable (i.e. the reference is lost).

9 Variables assigned to optical properties are not listed within the “Set Parametric Values” dialog within an Analysis Case, even if the Analysis Case does not reference a Radiative Case.

10 When an Analysis Case is reported, the global values of variables that are over-ridden locally within the Analysis Case are reported.

11 An entity containing an error is sometimes not flagged as an error (highlighted on the model tree) if the model is closed and re-opened.

12 Conductors are sometimes not generated correctly within FE geometry

13 When visualising a model in orbit, the view (direction and zoom level) is reset each time the next orbit position is selected

14 The "Set Parametrics Values" dialog within an Analysis Case incorrectly lists variables assigned to directed emission Boundary Conditions associated to a Radiative Case defined within the Analysis Case

15 Workbench fails creating the analysis file if the associated radiative results only contains albedo heat fluxes.

16 Within Workbench, the Define Real / Property dialog cannot be launched from the Define Geometry dialog, defining the capacitance override value for a non-geometric thermal node.

17 Variables referenced by an Analysis Case through the Set Parametrics Value dialog are sometimes not saved correctly when closing and reopening the model

18 Workbench outputs the radiative heat fluxes on non-Geometric Thermal Nodes as zero, rather than omitting the definition

19 Warning error for assembly's orientation not being taken into account during the radiative calculation does not display correctly.

20 Variables associated with a Radiative Case are incorrectly handled by the Set Parametrics Values dialog of a Analysis Case

21 When running an Analysis Case using language, in some circumstances variables can be redefined which are referenced by an associated Radiative Case (i.e. changing variables within an Analysis Case - which are referenced by an associated Radiative Case - will invalidate the radiative results and is not supported).

22 The Heat Flux Multiplier, defined within an Analysis Case, is not applied to the radiative conductors within the generated analysis file

23 Real Variables cannot be defined for the Contact Conductance through the Set Conductive Interface Connection Type dialog

24 The visualisation incorrectly resets back to the default view when displaying results

25 Invalid error messages are generated by Workbench if a Group is defined with invalid entries

26 The contact area of a Contact Zone is not recalculated if either the maximum gap or the number of sample points is assigned to a variable, and if the variable is subsequently modified

27 Models containing shell vector and/or matrix elements may fail in the automatic conductor generation

28 Workbench fails when the point definitions of a solid geometry are attribute edited

29 STEP-TAS import sets incorrect activity for split shells when imported active side is BOTH

30 Invalid language is generated and an error given, if the On or Off temperatures of a thermostatically controlled heat load Boundary Condition are not specified

31 Workbench fails when defining an Analysis Case that uses a Boundary Condition that references an inactive face

32 If a Radiative Case references a variable, the variable value is assigned when the Radiative Case is defined – subsequent updates to the variable are not taken into account unless the Radiative Case is redefined

33 Workbench can freeze when generating an Analysis Case if the Apply button is pressed repeatedly

34 Variables referenced by an Analysis Case through the Set Parametric Values dialog are sometimes not saved correctly when closing and reopening the mode

35 Workbench fails creating the analysis file if the associated radiative results only contains albedo heat fluxes.

36 Radiative case Execute dialogue does not save the solar ray propagation face selected when re-opened

37 When visualising a model in orbit, the view (direction and zoom level) is reset each time the next orbit position is selected

38 Initial Condition option is missing from the analysis case dialog when it is a thermal model only

39 When displaying Radiative Case data, the automatically calculated colour range for FE geometry is sometimes not correct, and the faces are displayed grey (out of range)

40 Invalid language is generated and an error given, if the On or Off temperatures of a thermostatically controlled heat load Boundary Condition are not specified

41 Real Variables cannot be defined for the Contact Conductance through the Set Conductive Interface Connection Type dialog

42 Workbench sometimes "freezes" when opening an Analysis Case or a Radiative Case

43 When running an Analysis Case using language, in some circumstances variables can be redefined which are referenced by an associated Radiative Case (i.e. changing variables within an Analysis Case. which are referenced by an associated Radiative Case, will invalidate the radiative results and is not supported).

44 Variables associated with a Radiative Case are incorrectly handled by the Set Parametric Values dialog of a Analysis Case

45 Workbench outputs the radiative heat fluxes on non-Geometric Thermal Nodes as zero, rather than omitting the definition

46 Within Workbench, the Define Real / Property dialog cannot be launched from the Define Geometry dialog, defining the capacitance override value for a non-geometric thermal node.

47 Invalid error messages are generated by Workbench if a Group is defined with invalid entries

48 Real variables rounded to 6 decimal places in reporting and dialogue

49 Conductive conductors are sometimes not generated correctly within FE geometry

50 An entity containing an error is sometimes not flagged as an error (highlighted on the model tree) if the model is closed and re-opened.

51 Variables assigned to optical properties are not listed within the "Set Parametric Values" dialog within an Analysis Case, even if the Analysis Case does not reference a Radiative Case

52 When an Analysis Case is reported, the global values of variables that are over-ridden locally within the Analysis Case are reported

53 If a variable is used to define an attribute (e.g. Geometry transformations), if the variable is defined as 0.0, the attribute is no longer bound to the variable (i.e. the reference is lost).

54 Workbench can fail if the Display Data dialog is open when another dialog is launched

55 The visualisation incorrectly resets back to the default view when displaying results

56 Variables can be defined multiple times within the Analysis Case Set Parametric Values dialog, and no error is given - the dialog drop-down list contains variables that have already been added to the Analysis Case

57 For models for which Conductive Interfaces have been created and then deleted, Workbench can fail when saving a model using Save As.

58 Workbench can freeze when generating an Analysis Case if the Apply button is selected repeatedly

59 The description field of a bulk or optical property is cleared when a name is entered

60 ESATAN-TMS fails to generate an analysis file, where shells have been defined using a shell vector, and through conductors are generated

61 Workbench may crash on include model when model contains invalid references

62 Workbench always reports Property information for a convective User-Defined Conductor, even when a Property has not been defined for the conductor.

63 An error is sometimes generated if geometry is created with a non-regular mesh, where the mesh positions have no be defined

64 Workbench fails when creating a model whose name has 112 characters or more

65 Incorrect help text for the emissivity of a radiative User-Defined Conductor

66 There are broken links within the Workbench Reference Manual; these are links to pages which have been removed from the manual

67 STEP-TAS import sets incorrect activity for split shells when imported active side is BOTH

68 The contact area of a Contact Zone is not recalculated if either the maximum gap or the number of sample points is assigned to a variable, and the variable is subsequently modified

69 Models containing shell vector and/or matrix elements may fail in the automatic conductor generation

70 Workbench fails when the point definitions of a solid geometry are attribute edited.

71 If a Radiative Case references a variable, the variable value is assigned when the Radiative Case is defined - subsequent updates to the variable are not taken into account unless the Radiative Case is redefined.

72 Cannot save analysis case if radiative case has not been executed

73 Workbench crashes when defining an analysis case that uses a boundary condition that references an inactive face

74 Conversion from ESATAN-TMS to STEP-TAS incorrectly populates Optical Diffuse Transmissivity instead of Direct Transmissivity

75 Changing variable bound to radiative case spin parameter does not flag results as out of date

76 Analysis case save button generates the same language as Apply

77 Dual composition shells with automatic node numbering export node numbers incorrectly to STEP-TAS

78 Conductive faces with automatic numbering export incorrect node numbers to STEP-TAS

79 Import from STEP-TAS shows incorrect node numbers for inactive faces

80 Running a radiative case when geometry in the moving component of an assembly does not have an optical assigned causes Workbench to crash.

81 Running full radiative analysis after validation run can lead to incorrect planet flux values

82 Exporting rectangle and triangle cutting tools to STEP-TAS generates empty invalid point definitions

83 Export from ESATAN-TMS to STEP-TAS generates error and stops conversion for doubly inactive shells

84 Bulk material exported to STEP-TAS for shells with a thickness value that is not greater than 0.0

85 Bulk and thickness values are not being exported to STEP-TAS for shells sides that are conductive

86 The Heat Flux Multiplier, defined within an Analysis Case, is not applied to the radiative conductors within the generated analysis file

87 Parsers stop working when invalid characters are pasted/typed in

88 Changing a variable bound to Initial Angle on a radiative case does not mark the results out of date

89 Export radiative case doesn't export a rotating model's rotation axis

90 Workbench can generate an error if the Analysis Case template file is manually deleted by the user (not through Workbench)

91 Analysis Case fails due to missing Environment Heat Fluxes

92 Workbench generates opticals with deprecated parameters when the optical property is angle-dependent

93 STEP-TAS converter does not support irregular mesh

94 FE geometry grey faces in heat flux overlay

Thermal

1 For very large models, Thermal can fail to generate the model FORTRAN file without generating an error message. For these models, generation of the FORTRAN is achieved by running Thermal with increased memory allocation.

2 Some of the formats of 2D and 3D table arrays do not accept a single value for one of the dimensions.

3 The ESATAN-TMS Thermal processor can fail if (inter-model) conductors are defined where the submodel names are very long.

4 FORTRAN generation step fails for large model.

5 Indistinct message given if external library routine referenced but not named in global file.

6 Preprocess fails for more than four levels of submodel nesting.

7 The ESATAN preprocessor doesn't read the following character "=" when it's the 80th character on the line.

8 ESATAN allows a real node attribute to be given a character value in $NODES without any warning/error produced.

9 the ESATAN-TMS Thermal User Manual incorrectly refers to Fortran 77, common blocks - Thermal has been updated to remove the use of common blocks

10 The ESATAN-TMS Thermal processor can fail if (inter-model) conductors are defined where the submodel names are very long

11 ESATAN-TMS Thermal log file has a spelling mistake (GF Condcutors => GF Conductors)

12 Some of the formats of 2D and 3D table arrays do not accept a single value for one of the dimensions

13 The length of a concatenated model name returned by library functions SUBMOD & SUMMDN is limited to 256 characters.

14 Incorrect library routine referenced in errors generated from PRNDTB

15 ESATAN allows a real node attribute to be given a character value in $NODES without any warning/error produced

16 Preprocess fails for more than 4 levels of submodel nesting

17 The ESATAN preprocessor doesn't read the following character "=" when it's the 80th character on the line.

18 Output routines, PRNCSV, PRNDBL, PRNDTB, PRTNAV, and PRTNSM, only allow a maximum of 29 entities to be specified. If more than 29 entities are required multiple calls must be made.

19 Indistinct message given if external library routine referenced but not named in global file

20 For very large models Thermal can fail to generate the model FORTRAN file without generating an error message. For these models, generation of the FORTRAN is achieved by running Thermal with increased memory allocation.

4 Points to Note

1 To improve the performance of the radiative analysis, no check is made for intersecting geometry. To validate the geometry, particularly when the model includes moving geometry, it is recommended that a validation run is performed – one of the checks performed during a validation run is that there is no interfering geometry at each orbit position. For more information, see the Workbench User Manual, section 7-18.

2 The language SET_ATTRIBUTE_RECURSIVE and DEFINE_SURFACE_PROPERTIES are deprecated and users should use the new, more flexible, language DEFINE_GEOMETRY_ATTRIBUTES. The new language has been introduced to support setting of the attributes of individual faces and volumes; see section 2 for more detail. For backwards compatibility of models, the existing language SET_ATTRIBUTE_RECURSIVE and DEFINE_SURFACE_PROPERTIES shall carry on being supported.

3 With ESATAN-TMS 2020 if a cavity is defined from a (sur)face that can directly or indirectly see the environment, then only those (sur)faces that can see the originating (sur)face either directly or via reflection from other (sur)faces will be included in the cavity (prior to ESATAN-TMS 2020 in this case the external cavity would be defined).

5 Upgrading from Previous Versions

ESATAN-TMS Workbench provides a smooth upgrade path from ESATAN-TMS 2017, ESATAN-TMS 2018 and ESATAN-TMS 2019.

On launch of Workbench, ESATAN-TMS checks the version of the associated user-library file (if present), and prompts to update the library. On opening the model, Workbench checks the model version number and, if a model from one of the versions listed above is detected, the option is given to automatically update the model to the new version.

Note that the upgrade of the model and the user-library is a permanent update and therefore after the update the files will not open in the previous version. It is therefore recommended that a copy of the model and the user-library file be made before proceeding with the update.

Please also note that the radiative results are not updated and the Radiative Case(s) will need to be rerun to regenerate the results.

6 Contact Information

If you have any questions regarding the new version or require further information, please contact our customer support at:

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