JMAG Version 11

JCF / PLOT File Format

JSOL Corporation

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Chapter 15. Editing a JCF File (Simple FHI)

This chapter describes how to edit a JCF file.

▶▶ Reference

For information about each parameter in a JCF file, see the PDF file in the JMAG install folder/documents.

15-1. Overview

Unlike solver files (text format), JCF files are stored in binary format. A file access library, SimpleFHI, is required to access to a JCF file.

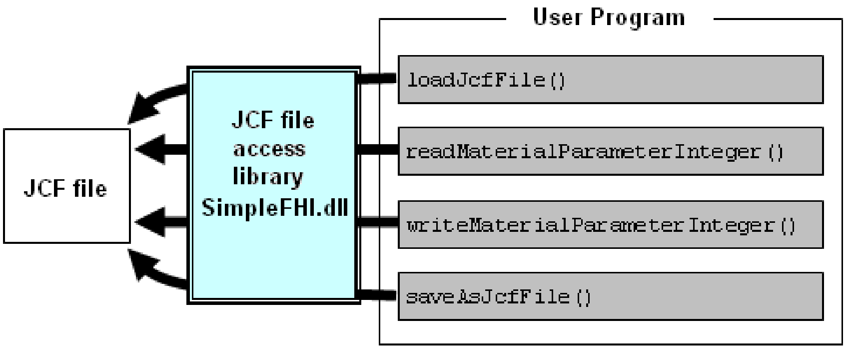
An external program can confirm and edit the values specified for parameters using SimpleFHI, and save the changes in a new file.

■ Editing a JCF file

1. Write program codes appropreate for changing parameters.

2. Link the program to the file access library, SimpleFHI.

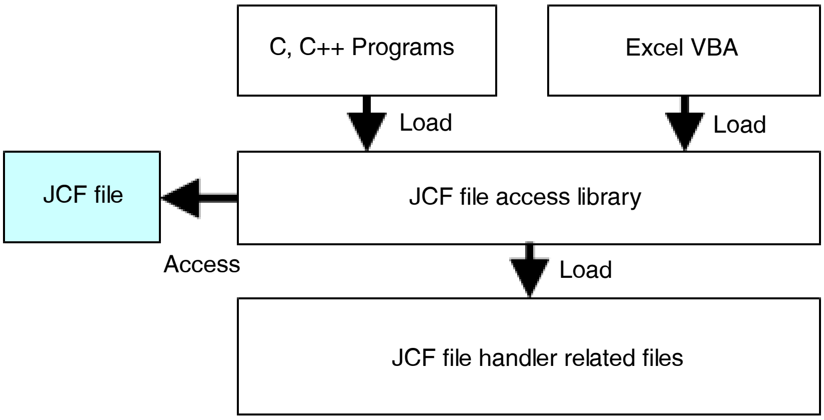
3. Build the program, and then execute it.



Editing a JCF file

■ Access to a JCF file

A JCF file can be accessed as follows.



Access to a JCF file

The library of SimpleFHI loads some JCF file handlers as sub- libraries.

15-2. Environment Required for Editing JCF Files

15-2-1. Programs

Either one of the following programs is required.

- Excel (Windows only)
- C, C++ programs (Windows/Linux)

15-2-2. Files

The following files are required to access a JCF file.

	Windows	Linux
JCF file access library	• SimpleFHI.dll (INS_DIR)	N/A (The static library is used.)
Files required to build the C and C++ programs	• SimpleFHI.h • SimpleFHI.lib (INS_DIR\Tools\SimpleFHI)	• libSimpleFHI.a (INS_DIR/solver/mod/tools/SimpleFHI/lib) • SimpleFHI.h (INS_DIR/solver/mod/tools/SimpleFHI/include)
JCF file handler files (required to build and execute a program)	• filehandler.dll • icudt20.dll • icuuc20.dll • xerces-c_1_6_0.dll (INS_DIR)	• libFileHandler.a • libicudtata.so • libicuuc.so • libxerces-c1_6_0.so For 32bit (INS_DIR/solver/mod/lib/linux32) For 64bit (INS_DIR/solver/mod/lib/linux64)

Important **INS_DIR indicates the JMAG installation directory.**
e.g. JMAG-Studio: C:\Program Files\JMAG-Studio10.0
e.g. Linux: /usr/works

The following files are provided as samples.

■ Sample code (C, C++ programs)

■ Location (Windows):

```
\(JMAG installation directory)\Tools\SimpleFHI\samples\C
```

- main.c
  This file contains sample source codes.
- sample.dsp
  This file is a project file containing sample source codes.
- sample.dsw
  This file is a workspace file containing sample.dsp.
- sample.jcf
  This is a sample JCF file.

■ Location (Linux):

```
(installation directory)/solver/mod/tools/SimpleFHI/
samples/C/Sample
```

- main.c
  This file contains sample source codes.
- sample.jcf
  This is a sample JCF file.
- Makefile
  This file is needed for a build.
- SimpleFHI
  This is a program name created after a build.

■ Sample code (Excel VBA)

■ Location (Windows only):

```
\(JMAG installation
directory)\Tools\SimpleFHI\samples\ExcelVBA
```

- check_data.jcf
  This is a sample JCF file.
- declaration.txt
  This file contains declarations to reference functions provided by SimpleFHI.dll.
  This file needs to be copied to a macro.
- sample.xls
  This file contains a sample Excel spread sheet and VBA source codes.

15-3. Functions of JCF File Access Library (SimpleFHI)

The JCF file access library, SimpleFHI, contains the following functions.

The terms [in] and [out] used in the following description indicate "input" and "output," respectively.

■ Functions for initialization

```
long loadJcfFile
(const char* path, JcfDataPtr* result);
```

Description	Opens a JCF file, and initializes the data for management.
Parameters	path[in] : path to an input JCF file result[out] : pointer-indicating data for management
Return value	1: success, 0: failure

■ Functions for handling files

```
long saveAsJcfFile
(JcfDataPtr data, const char* path);
```

Description	Attaches a name to a JCF file and stores the resulting file.
Parameters	data[in] : pointer-indicating data for management path[out] : path to a location where the JCF file is stored.
Return value	1: success, 0: failure

```
void closeJcfFile
(JcfDataPtr data);
```

Description	Closes the JCF file linked to the data indicated by the data pointer "data".
Parameters	data[in] : pointer indicating data for management
Return value	none

■ Functions for control parameters

```
long readControlParameterInteger
(JcfDataPtr data, const char* moduleName, const char*
paramName, long* result);
```

Description	Reads control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter result[out] : obtained value (integer)
Return value	1: success, 0: failure

```
long readControlParameterDouble
(JcfDataPtr data, const char* moduleName, const char*
paramName, double* result);
```

Description	Reads control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter result[out] : obtained value (floating point number)
Return value	1: success, 0: failure

```
long readControlParameterComplex
(JcfDataPtr data, const char* moduleName, const char*
paramName, double* real, double* img);
```

Description	Reads control parameters.
Parameters	data[in]pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter real[out] : obtained value (real part of a complex number) img[out] : obtained value (imaginary part of a complex
Return value	1: success, 0: failure

```
long readControlParameterString(JcfDataPtr data, const char*
moduleName, const char* paramName, char* buff, int n);
```

Description	Reads control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter buff[out] : buffer for storing a string obtained n[in] : size of buffer for the string
Return value	1: success, 0: failure

```
long writeControlParameterInteger
(JcfDataPtr data, const char* moduleName, const char*
paramName, long value);
```

Description	Writes control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter value[in] : written value (integer)
Return value	1: success, 0: failure

```
long writeControlParameterDouble
(JcfDataPtr data, const char* moduleName, const char*
paramName, double value);
```

Description	Writes control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter value[in] : written value (floating point number)
Return value	1: success, 0: failure

```
long writeControlParameterComplex
(JcfDataPtr data, const char* moduleName, const char*
paramName, double real, double img);
```

Description	Writes control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter real[in] : written value (real part of a complex number) img[in] : written value (imaginary part of a complex number)
Return value	1: success, 0: failure

```
long writeControlParameterString
(JcfDataPtr data, const char* moduleName, const char*
paramName, const char* str);
```

Description	Writes control parameters.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of module paramName[in] : name of parameter str[in] : written string
Return value	1: success, 0: failure

■ Functions for setting conditions

```
long createCondition
(JcfDataPtr data, const char* condName);
```

Description	Creates conditions.
Parameters	data[in] : pointer indicating data for management moduleName[in] : name of condition
Return value	1: success, 0: failure

```
void removeCondition
(JcfDataPtr data, const char* condName, int id);
```

Description	Deletes a condition by nominating the ID of the condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition
Return value	1: success, 0: failure

```
long countConditions
(JcfDataPtr data, const char* condName);
```

Description	Acquires the required number of conditions.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition
Return value	Number of conditions

```
long getIndexByConditionId
(JcfDataPtr data, const char* condName, int id);
```

Description	Acquires the ordinal number of a condition whose ID is specified.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition
Return value	Ordinal number
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionParameterInteger
(JcfDataPtr data, const char* condName, int id, const char*
paramName, long* result);
```

Description	Reads condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter result[out] : obtained value (integer)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long readConditionParameterDouble
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double* result);
```

Description	Reads condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter result[out] : obtained value (floating point number)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number (“id” is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long readConditionParameterComplex
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double* real, double* img);
```

Description	Reads condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter real[out] : obtained value (real part of a complex number) img[out] : obtained value (imaginary part of a complex number)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number (“id” is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long readConditionParameterString
(JcfDataPtr data, const char* condName, int id, const char*
paramName, char* buff, int n);
```

Description	Reads condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter buff[out] : buffer for storing a string obtained n[in] : size of buffer for the string
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long readConditionParameterPoint
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double* x, double* y, double* z);
```

Description	Reads condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter x[out] : obtained value (x-component) y[out] : obtained value (y-component) z[out] : obtained value (z-component)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long writeConditionParameterInteger
(JcfDataPtr data, const char* condName, int id, const char*
paramName, long value);
```

Description	Writes condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter value[in] : written value (integer)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long writeConditionParameterDouble
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double value);
```

Description	Writes condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter value[in] : written value (floating point number)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long writeConditionParameterComplex
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double real, double img);
```

Description	Writes condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter real[in] : written value (real part of a complex number) img[in] : written value (imaginary part of a complex number)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long writeConditionParameterString
(JcfDataPtr data, const char* condName, int id, const char*
paramName, const char* str);
```

Description	Writes condition parameters.
Parameters	data[in]pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter str[in] : written string
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number ("id" is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long writeConditionParameterPoint
(JcfDataPtr data, const char* condName, int id, const char*
paramName, double x, double y, double z);
```

Description	Writes condition parameters.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition id[in] : ID of condition paramName[in] : name of parameter x[in] : written value (x-component) y[in] : written value (y-component) z[in] : written value (z-component)
Return value	1: success, 0: failure
Remarks	For conditions without a conditional number (“id” is not included in the parameter names) such as the step condition, the conditional number is set to zero (0).

```
long countConditionGroups
(JcfDataPtr data, const char* condName, int id);
```

Description	Obtains the number of groups included in the specified condition.
Parameters	data[in]: pointer indicating data for management condName[in]: name of condition id[in]: ID of condition
Return value	Number of groups

```
long countConditionGroupElments
(JcfDataPtr data, const char* condName, int id, int
groupIndex);
```

Description	Obtains the number of elements in the group included in the specified condition.
Parameters	data[in]: pointer indicating data for management condName[in]: name of condition id[in]: ID of condition groupIndex[in]: Group ordinal number
Return value	Number of elements
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionGroupType
(JcfDataPtr data, const char* condName, int id, int
groupIndex);
```

Description	Obtains the group type of the specified group by condition ID and group ordinal number. The following group types can be specified. 0 => Node 1 => Element 2 => Element face 3 => Element edge 4 => Region 5 => Region edge 6 => Solid 7 => Solid face
Parameters	data[in]: pointer indicating data for management condName[in]: name of condition id[in]: ID of condition groupIndex[in]: Group ordinal number
Return value	Group type
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionGroup
(JcfDataPtr data, const char* condName, int id, int
groupIndex, int elementIndex, long* firstId, long*
secondId);
```

Description	Obtains the ID of the elements, nodes, and element faces in the specified group. A group can be specified by the condition ID or group ordinal number.
Parameters	data[in]: pointer indicating data for management condName[in]: name of condition id[in]: ID of condition groupIndex[in]: Group ordinal number elementIndex[in]: Group element ordinal number firstId[out]: ID of an element or node secondId[out]: ID of an element face
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
void removeConditionByIndex
(JcfDataPtr data, const char* condName, int index);
```

Description	Deletes the condition specified by a ordinal number.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in]: Condition ordinal number
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionParameterIntegerByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, long* result);
```

Description	Reads the parameters set for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in]: Condition ordinal number paramName[in]: Parameter name result[out]: Obtained value (integer)
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain “id”) such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionParameterDoubleByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, double* result);
```

Description	Reads the parameters set for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in]: Condition ordinal number paramName[in]: Parameter name result[out]: Obtained value (float)
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain "id") such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readConditionParameterStringByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, char* buff, int n);
```

Description	Reads the parameters set for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in]: Condition ordinal number paramName[in]: Parameter name buff[out]: Buffer for storing the obtained string n[in]: Buffer size
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain "id") such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeConditionParameterIntegerByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, long value);
```

Description	Sets the parameters for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in] : Condition ordinal number paramName[in] : Parameter name value[in] : Output value (integer)
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain “id”) such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeConditionParameterDoubleByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, double value);
```

Description	Sets the parameters for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in] : Condition ordinal number paramName[in]: Parameter name value[in]: Output value (float)
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain “id”) such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeConditionParameterStringByIndex
(JcfDataPtr data, const char* condName, int index, const
char* paramName, const char* str);
```

Description	Sets the parameters for a condition.
Parameters	data[in] : pointer indicating data for management condName[in] : name of condition index[in] : Condition ordinal number paramName[in] : Parameter name str[in] : String to be output
Return value	1: success, 0: failure
Remarks	• For the conditions that do not have a condition ID (parameter name does not contain “id”) such as the Step condition, set Condition ID to zero (0). • Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

■ Functions for setting materials

```
long countMaterials
(JcfDataPtr data);
```

Description	Acquires the number of materials whose name is specified.
Parameters	data[in] : pointer indicating data for management
Return value	Number of materials

```
long readMaterialParameterInteger
(JcfDataPtr data, int id, const char* paramName, long*
result);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter result[out] : obtained value (integer)
Return value	1: success, 0: failure

```
long readMaterialParameterDouble
(JcfDataPtr data, int id, const char* paramName, double*
result);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter result[out] : obtained value (integer)
Return value	1: success, 0: failure

```
long readMaterialParameterComplex
(JcfDataPtr data, int id, const char* paramName, double*
real, double* img);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter real[out] : obtained value (real part of a complex number) img[out] : obtained value (imaginary part of a complex number)
Return value	1: success, 0: failure

```
long readMaterialParameterString
(JcfDataPtr data, int id, const char* paramName, char* buff,
int n);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter buff[out] : buffer for storing a string obtained n[in] : size of buffer for the string
Return value	1: success, 0: failure

```
long writeMaterialParameterInteger
(JcfDataPtr data, int id, const char* paramName, long
value);
```

Description	Writes the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter value[in] : written value (integer)
Return value	1: success, 0: failure

```
long writeMaterialParameterDouble
(JcfDataPtr data, int id, const char* paramName, double
value);
```

Description	Writes the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter value[in] : written value (floating point number)
Return value	1: success, 0: failure

```
long writeMaterialParameterComplex
(JcfDataPtr data, int id, const char* paramName, double
real, double img);
```

Description	Writes the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter real[in] : written value (real part of a complex number) img[in] : written value (imaginary part of a complex number)
Return value	1: success, 0: failure

```
long writeMaterialParameterString
(JcfDataPtr data, int id, const char* paramName, const char*
str);
```

Description	Writes the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter str[in] : written string
Return value	1: success, 0: failure

```
long readMaterialParameterIntegerByIndex
(JcfDataPtr data, int index, const char* paramName, long*
result);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in] : name of parameter result[out] : Obtained value (integer)
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readMaterialParameterDoubleByIndex
(JcfDataPtr data, int index, const char* paramName, double*
result);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management id[in] : ID of material paramName[in]: Parameter name result[out]: Obtained value (float)
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readMaterialParameterComplexByIndex
(JcfDataPtr data, int index, const char* paramName, double*
real, double* img);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management index[in]: Material ordinal number paramName[in] : Parameter name real[out]: Obtained value (real complex value) img[out] : Obtained value (imaginary complex value))
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long readMaterialParameterStringByIndex
(JcfDataPtr data, int index, const char* paramName, char*
buff, int n);
```

Description	Reads the parameters set for a material.
Parameters	data[in] : pointer indicating data for management index[in]: Material ordinal number paramName[in] : Parameter name buff[out]: Buffer for storing the obtained string n[in]: Buffer size
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeMaterialParameterIntegerByIndex
(JcfDataPtr data, int index, const char* paramName, long
value);
```

Description	Sets the parameters for a material.
Parameters	data[in] : pointer indicating data for management index[in]: Material ordinal number paramName[in]: Parameter name value[in]: Output value (integer)
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeMaterialParameterDoubleByIndex
(JcfDataPtr data, int index, const char* paramName, double
value);
```

Description	Sets the parameters for a material.
Parameters	data[in] : pointer indicating data for management index[in]: Material ordinal number paramName[in]: Parameter name value[in]: Output value (float)
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeMaterialParameterComplexByIndex
(JcfDataPtr data, int index, const char* paramName, double
real, double img);
```

Description	Sets the parameters for a material.
Parameters	data[in] : pointer indicating data for management index[in] : Material ordinal number paramName[in] : Parameter name real[in] : Output value (real complex value) img[in] : Output value (imaginary complex value)
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

```
long writeMaterialParameterStringByIndex
(JcfDataPtr data, int index, const char* paramName, const
char* str);
```

Description	Sets the parameters for a material.
Parameters	data[in] : pointer indicating data for management index[in] : Material ordinal number paramName[in]: Parameter name str[in] : String to be output
Return value	1: success, 0: failure
Remarks	Ordinal numbers (index) and IDs are different. IDs may not be consecutive missing some numbers in the middle, whereas ordinal numbers are always consecutive.

15-4. Using the JCF File Access Library (SimpleFHI)

15-4-1. Using C Language

15-4-1-1. Building/Executing a Sample Using VisualC++

Description will be given below on the assumption that the computer has Microsoft VisualC++ version 6.0 installed on Microsoft Windows 2000/XP.

1. Set Path for the environment parameter of Windows.

i. Select [Control Panel] from the Windows [start] menu (in the case of Windows XP).

ii. Select the "System" button in Control Panel by double-clicking it.

The [System Properties] dialog box will appear.

iii. Click the [Advanced] tab, and then click [Environment Variables].

The [Environment Variables] dialog box will appear.

iv. Select "Path" parameter in the list, and then click [Edit].

The [User Edition Parameters] dialog box will appear.

v. Into the [Parameters Value] text box, enter the installation directory of JMAG.

2. Start VisualC++, version 6.0 (VC hereinafter).

3. Set an included path of VC.

i. Select [Tools] > [Options] from the VC menu bar.

The [Options] dialog box will appear.

ii. Click the [Directories] tab, and then select "Include files" from the [Show Directories for] combo box.

iii. Add \(JMAG installation directory)\Tools\SimpleFHI to the [Directories] list box.

4. Set library path.

i. Select [Tools] > [Options] from the VC menu bar.

The [Options] dialog box will appear.

ii. Click the [Directories] tab, and then select "Library files" from the [Show Directories for] combo box.

iii. Add \(JMAG installation directory)\Tools\SimpleFHI to the [Directories] list box.

5. Read the sample project file.

The location for storing the project file is as follows.

```
(JMAG Installation
directory)\Tools\SimpleFHI\samples\C\Sample.dsp
```

To prepare a new project, it is necessary to perform the following settings (the settings have been implemented in the case of Sample.dsp described above).

i. Select [Project] > [Settings] from the VC menu bar.

The [Project Settings] dialog box will appear.

ii. Click the [C/C++] tab.

iii. Select [Generation of Code] from the [Category] combo box, and [Multi-Thread (DLL)] from the [Use run-time library] combo box.

iv. Click the [Link] tab.

v. Select "General" in the [Category] combo box, and then enter "Simple-FHI.lib" into the [Object/library modules] text box.

6. Build the file.

i. Select [Build (B)] > [Build (B)] from the menu bar.

Sample.exe is prepared.

7. Execute Sample.exe.

Open the command prompt, and then execute the following command.

```
sample input_jcf_file_name output_jcf_file_name
```

15-4-1-2. Building/Executing a Sample Using Visual Studio.Net

1. **Set Path for the environment parameter of Windows.**

   i. **Select [Control Panel] from the Windows Start menu (in the case of Windows XP).**

   ii. **Select the "System" button in Control Panel by double-clicking it.**

   The [System Properties] dialog box will appear.

   iii. **Click the [Advanced] tab, and then click [Environment Variables].**

   The [Environment Variables] dialog box will appear.

   iv. **Select "Path" parameter in the list, and then click [Edit].**

   The [User Edition Parameters] dialog box will appear.

   v. **Into the [Parameters Value] text box, enter the installation directory of JMAG.**

2. **Start Visual Studio.Net 2003 (VS hereinafter).**

3. **Set an included path of VS.**

   i. **Select [Tools] > [Options] from the VS menu bar.**

   The [Options] dialog box will appear.

   ii. **Click the [Directories] tab, and then select "Include files" from the [Show Directories] combo box.**

   iii. **Add \(JMAG installation directory)\Tools\SimpleFHI to the [Directories] list box.**

4. **Set library path.**

   i. **Select [Tools] > [Options] from the VS menu bar.**

   The [Options] dialog box will appear.

   ii. **Select [Project] > [VC++ Directories] via the tree.**

   iii. **Select "Library files" from the [Show Directories for] combo box.**

   iv. **Add \(JMAG installation directory)\Tools\SimpleFHI to the list box.**

5. Read the sample project file.

The location for storing the project file is as follows.

```
(JMAG installation
directory)\Tools\SimpleFHI\samples\C\Sample.vcproj
```

To prepare a new project, it is necessary to perform the following settings (the settings have been implemented in the case of the Sample.vcproj described above).

i. Select (Project Name) using the solution explorer.

ii. Select [Project] > [Properties] from the VS menu bar.

The [(name of project) Property Page] dialog box will appear.

iii. Select [Configuration Properties] > [Linker] > [Input] via the tree.

iv. Add SimpleFHI.lib to the [Additional Dependencies] cell.

v. Select [Configuration Properties] > [C/C++] > [Precompiled Headers] via tree.

vi. Select [Not Using Precompiled Headers] in the [Create/Use Precompiled Header] cell.

6. Build file.

i. Select [Build] > [Build Sample] from the menu bar.

ii. Sample.exe is prepared.

7. Execute Sample.exe.

Open the command prompt, and then execute the following command.

```
sample input_jcf_file_name output_jcf_file_name
```

15-4-1-3. Building/Executing a Sample Code Using Linux

1. Move to the directory where the sample code is located.

```
(JMAG Installation directory) /solver/mod/tools/SimpleFHI/
samples/C/Sample
```

2. Run the make command.

SimleFHI is generated.

3. Specify the directory containing the JCF file handler-related files for the environmental variable LD_LIBRARY_PATH.

(Example of a command using bash: 32bit)

```
LD_LIBRARY_PATH=(installation directory)/solver/mod/lib/
linux32
export LD_LIBRARY_PATH
```

4. Run SimleFHI.

Run the next command. (Make sure to leave a space between the command and file name.)

```
SimleFHI input_JCF_file_name output_JCF_file_name
```

15-4-2. Using Excel VBA

15-4-2-1. Using a Sample Macro

Description will be given below on the assumption that the computer has Microsoft Excel installed on Microsoft Windows 2000/XP.

1. Set path for the environment parameters of Windows.

i. Select [Control Panel] from the Windows [start] menu (in the case of Windows XP).

ii. Select the "System" button in Control Panel by double-clicking it.

The [System Properties] dialog box will appear.

iii. Click the [Advanced] tab, and then click [Environment Variables].

The [Environment Variables] dialog box will appear.

iv. Select "Path" parameter in the list, and then click [Edit].

The [User Edition Parameters] dialog box will appear.

v. Into the [Parameters Value] text box, enter the installation directory of JMAG.

2. Start Microsoft Excel (Excel hereinafter).

3. Change the macro security level.

i. Select [Tools] > [Options] from the Excel menu bar.

The [Options] dialog box will appear.

ii. Click the [Security] tab, and then click [Macro Security].

The [Security] dialog box will appear.

iii. Click the [Security Level] tab, and then select the [Intermediate] radio button.

Important **Changing the macro security level may increase the risk of making your machine susceptible to the attack of external rogue programs. This operation should be performed with utmost care in accordance with the security policy adopted by the company or group to which you belong.**

4. Read the sample file.

i. Open the sample at \(JMAG installation directory)\ Tools\SimpleFHI\samples\ExcelVBA\sample.xls.

ii. A message dialog will appear that reads "'...\sample.xls' contains macro." Click the [Activate Macro] button.

5. Execute the sample file.

i. Select the [JCF Editing Sample] sheet.

ii. Click the [Read...] button.

The [Open File] dialog box will appear.

iii. Select a desired JCF file, and then click [Open]. In the [Name of File to be Opened] cell, there appears the name of the selected file.

The values used for the setting of the file are read into the cell.

iv. Change the values in the cell as appropriate.

v. Click the [Write...] button.

The [Name File for Storage] dialog box will be displayed.

vi. Enter a name of the file, and then click [Storage].

6. Verify the source codes of ExcelVBA.

i. Select [Tools] > [Macro] > [Macro] from the Excel menu bar.

The [Macro] dialog box will appear.

ii. Click the [Edit] button.

To use the API of SimpleFHI in ExcelVBA, it is necessary to copy declare.txt and paste its contents to the file (sample.xls has necessary contents pasted in advance). The part in question in sample.xls is as seen below.

```
' Reference to the parameters provided by SimpleFHI.dll is
declared.
' (begin)------------------------------------------

' Loading JCF file
Public Declare Function loadJcfFile Lib "SimpleFHI" (ByVal
path As String, ByRef ptr As Long) As Long
  :
(omitted)
  :
```

```
Public Declare Function writeMaterialParameterString Lib
"SimpleFHI" _
(ByVal ptr As Long, ByVal index As Long, ByVal paramName As
String, ByVal str As String) As Long

' (end)------------------------------------------
```

Reference

For the details of Excel VBA, see reference books commercially available.

Chapter 16. Extracting Data from a Result File (JMAG-Designer)

This chapter describes extracting data from a JMAG-Designer project file (*.jproj) or a result file (*.jplot) using the data extraction tool without running JMAG-Designer.

16-1. Function

Project files (*.jproj) or result files (*.jplot) for JMAG-Designer are described in binary format.

Therefore, this function is used when extracting result data from binary files.

This tool has the following characteristics.

- This tool is a console application.
- This tool can be used in either Windows or Linux environment.
- Specifies a result file (*.jplot) or a calculated project file (*.jproj) when extracting a result data.
- Specifies a project file (*.jproj) when extracting parameters for settings.
- Data for results or parameters for settings that are extracted are exported as standard output text files.

16-2. Important Notes Regarding the Use of this Function

- The following types of data for results can be exported.
  - Items that are exported as values for each step
- The following types of data for results cannot be extracted.
  - Items that have an amount of distribution
  - Items that require processing in JMAG-Designer such the probe setting
- A JCF file (*.jcf) and a result file (*.jplot) need to be exported to the Case folder under the jfiles folder when extracting result data or setting parameters from a project file (*.jproj).

  MEMO A jfiles folder is automatically created when a project file (*.jproj) is saved. For example, a folder is created in the following hierarchy structure when a JMAG-Designer project is saved in the D drive of the machine (project name: AAA, model name: BBB, study name: CCC)

  D:\AAA.jfiles\BBB~0\CCC~1\Case1

  The [AAA.jfiles] is for [jfiles].

  MEMO A JCF file (*.jcf) and a result file (*.jplot) is exported to a Case folder when running a calculation for a study.

16-3. Running Procedures (Windows/Linux)

The following are explanations on the operations for this tool.

- Extracting result data
- Obtains list of output items
- Obtains a list for a model or a study included in the project
- Obtains value for each parameter set in a project

16-3-1. Important Notes Regarding the Descriptions of Commands

The following should be noted when using this function.

- File paths and query needs to be enclosed in double quotation marks (").
- Command lines and arguments needs to be defined in one line.
  A conjunction [^] symbol needs to be placed after a line break when dividing a command line into two lines in a Windows environment. A backslash [\ ] symbol needs to be placed after a line break when dividing a command line into two lines in a Linux environment.

16-3-2. Extracting Result Data

A result data is extracted by specifying a result file (*.jplot) or a project file (*.jproj).

1. Specify the following command.

■ **Extracting result files (*.jplot)**

```
“(JMAG installation directory)\jquery.exe” -file=”JPLOT
file” -query=”select (component) from /(output item)”
```

Example: Extracting the X, Y, and Z component of an electromagnetic force from jmag.jplot.

```
“C:\Program Files\JMAG-Designer11.0\jquery.exe” -
file=”D:\work\jmag.jplot” -query=”select X Y z from /Force”
```

■ **Extracting from a project file (*.jproj)**

```
”(JMAG installation directory)\jquery.exe” -file=”JPLOJ
file” -query=”select (component) from /(Model name/Study
name/Case name/Output items)”
```

Example: Extracting the X, Y, and Z component of a model AAA/study BBB/Case1 from jmag.jploj.

```
“C:\Program Files\JMAG-Designer11.0\jquery.exe” -
file=”D:\work\jmag.jproj” -query=”select X Y z from
modelAAA/studyBBB/case1/Force”
```

- The result data is exported as standard output in default settings. Use the options that are described below when exporting a file.
- Specify the model name, study name, and Case name when extracting result data from a project file (*.jproj).
- For more information about names for output items and components, see the following table.

■ Options

The following items can be specified as an option. The following default values in the table are used if an option is not specified.

Property name	Setting	Default	Description
-out	String		Specify the path for file export. Specify absolute path.
-format	"plain" "csv"	plain	Specify the format for file export. Plain text format CSV format

■ Output Items and component list

The output items that can be extracted are as follows.

Output items	Component	Description	Related analysis type
JouleLoss	Loss	Joule loss	Magnetic field analysis
HysteresisLoss	Loss	Hysteresis loss	Magnetic field analysis
Force	• X • Y • Z • Torque	Electromagnetic force (X, Y, Z) , Torque	Magnetic field analysis, electric field analysis
LorentzForce	• X • Y • Z	Lorentz force (X, Y, Z)	Magnetic field analysis
Flux	Flux	Magnetic flux	Magnetic field analysis (static analysis, transient response analysis)
FluxReal	Flux	Magnetic flux (real)	Magnetic field analysis (frequency response analysis)
FluxImaginary	Flux	Magnetic flux (imaginary)	Magnetic field analysis (frequency response analysis)
TerminalVoltage	Voltage	Circuit Voltage (real)	Magnetic field analysis (transient response analysis, frequency response analysis)

Output items	Component	Description	Related analysis type
TerminalVoltageImaginary	Voltage	Circuit Voltage (imaginary)	Magnetic field analysis (frequency response analysis)
LineCurrent	Current	Current (real)	Magnetic field analysis (transient response analysis, frequency response analysis), electric field analysis
LineCurrentImaginary	Current	Current (imaginary)	Magnetic field analysis (frequency response analysis)
StoredEnergy	Energy	Stored energy	Magnetic field analysis
Inductance	Inductance	Winding inductance	Transformer analysis
DcResistance	Resistance	Winding DC resistance	Transformer analysis
CoilFlux	Flux	Flux linkage in coil	Transformer analysis
LineOnOff	Switch	ON/OFF information for circuit switch component	Magnetic field analysis
CurrentFlux	• Real • Imaginary	Magnetic flux for current condition (real, imaginary)	Magnetic field analysis
CoilFlux	• Real • Imaginary	Magnetic flux for FEM coil condition (real, imaginary)	Magnetic field analysis
CurrentCurrent	• Real • Imaginary	Current for current condition (real, imaginary)	Magnetic field analysis
CoilCurrent	• Real • Imaginary	Current for FEM coil condition (real, imaginary)	Magnetic field analysis
Displacement	• X • Y • Z • Angle	Total displacement (X,Y,Z, rotation angle)	Magnetic field analysis, thermal analysis
BrushAngle	Angle	Contact angle for Brush motor and Commutator components	Magnetic field analysis

Output items	Component	Description	Related analysis type
SurfaceCharge	Charge	Surface charge	Electric field analysis (static analysis, current distribution analysis)
SurfaceChargeReal	Charge	Surface charge (real)	Electric field analysis (frequency response analysis)
SurfaceChargeImaginary	Charge	Surface charge (imaginary)	Electric field analysis (frequency response analysis)
IronIronloss	• X • Y • Z	Iron loss (each component)	Iron loss analysis
IronHysteresisLoss	• X • Y • Z	Hysteresis loss (each component)	Iron loss analysis
IronJouleLoss	• X • Y • Z	Joule loss (each component)	Iron loss analysis
HeatFlow	Heat	Heat flow	Thermal analysis
HeatGeneration	Heat	Heat source	Magnetic field analysis, thermal analysis
AverageTemperature	Temperature	Average temperature	Thermal analysis
TerminalTemperature	Temperature	Terminal temperature	Thermal analysis

16-3-3. Obtaining List of Output Items

A list of output items included in a result file (*.jplot) or a project file (*.jproj) is obtained by specifying the file.

1. Specify the following command.

■ **Obtaining from result files (*.jplot)**

```
“(JMAG installation directory)\jquery.exe” -file=”JPLOT
file” -query=”describe”
```

■ **Obtaining from project files (*.jproj) by specification**

```
“(JMAG installation directory)\jquery.exe” -file=”JPROJ
file” -query=”describe /(Model name/Study name/Case name)”
```

16-3-4. Obtaining a List for a Model or a Study Included in the Project

A list of models or studies that is included in a project file (*.jproj) can be obtained by specifying the file.

1. Specify the following command.

■ **Obtaining a list of models**

```
“(JMAG installation directory)\jquery.exe” -file=”JPLOJ
file” -query=”select name from /”
```

■ **Obtaining a list of studies**

```
”(JMAG installation directory)\jquery.exe” -file=”JPLOJ
file” -query=”select name from /(model name)”
```

MEMO Some of the data in the list for models or studies may be different depending on the version of JMAG-Designer the project file is saved in.

16-3-5. Obtaining Values set in Each Parameter of a Project

The values set in each parameter of an analysis model can be obtained by specifying a project file (*.jproj).

1. Specify the following command.

```
”(JMAG installation directory)\jquery.exe” -file=”JPROJ
file” -query=”select (parameter name and number) from /
(Model name/Study name/Case name)”
```

Example: Obtaining values for stack length and step divisions from model AAA/study BBB/Case1 of jmag.jproj.

```
“C:\Program Files\JMAG-Designer11.0\jquery.exe” -
file=”D:\work\jmag.jproj” -query=”select Control-1/
model_thickness Step-1/step_division from modelAAA/studyBBB/
case1”
```

MEMO Always specify a model name or study name.

MEMO The values for entire cases that are included in a study can be obtained by omitting the [Case name] from the command.
Example: Obtaining the value of stack length from model AAA/study BBB/entire cases of jmag.jproj.

```
"C:\Program Files\JMAG-Designer11.0\jquery.exe" -
file="D:\work\jmag.jproj" -query="select Control-1/
model_thickness from modelAAA/studyBBB"
```

MEMO Specify the block name and property name that is described in a JCF file as a parameter name.

▶▶ Reference

For more information about block names and property names for JCF files, see "JCF/PLOT File Format."

Appendix A. JCF File Format (Mesh)

This chapter describes various parameters that can be edited using a JCF file.

A-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:
-Target (Element ID, etc.)
-Type of item to be applied (Element face or nodal point, etc.)
-Contents of point sequence data used under conditions or material characteristics

A-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	Mesh	Controls parameters related to the mesh generation function (mesh properties)(P. 45).
condition_data	SkinDepth	Controls parameters for skin depth(P. 49).
	LayerMesh	Controls parameters for layered mesh(P. 49).
	ThinShell	Controls parameters for thin shell mesh(P. 50).
	PartRelation	Controls parameters for part relation(P. 50).
	CopyMeshManual	Controls parameters for rotation periodic mesh (details)(P. 50).
	CopyMeshAuto	Controls rotation periodic mesh (automatic)(P. 52).
	DefeatureHole	Controls parameters for defeaturing (hole)(P. 53).
	DefeatureBlend	Controls parameters for defeaturing (fillet)(P. 53).
	DefeatureChamfer	Controls parameters for defeaturing (chamfer)(P. 53).
	MeshMorphingLinear	Controls parameters for morphing (linear)(P. 54).
	MeshMorphingRadial	Controls parameters for morphing (radial)(P. 54).
	ExtrusionDirection	Controls parameters for extrusion direction(P. 54)

A-3. Basic Information of Analysis (control_parameters)

- **Mesh**

In the mesh module, the items related to mesh creation are set.

MEMO In projects, where setting the auto-generation flag of air region "flg_air_region_generation" is not possible, the thickness of thin board, skin depth, inclusive flag of block, etc. cannot be used.

Item name	Parameter name	Type	Description
Mesh generation executable flag	flg_mg_execute	int	=0: A mesh generator is not used. =1: Patch mesh for generating a mesh every time. =2: Rotary patch mesh
Mesh type	flg_silde_type	int	=0: Automatic generation =1: Cylindrical slide mesh =2: Translational slide mesh
Type of input data	flg_mg_model_type	int	=0: none =1: 2D element =2: 2D region =3: 3D element =4: 3D Solid
2D Element type	flg_mg_2d_elem_type	int	=0: Triangle =1: Quadrangle

Parameters for slide mesh

Number of radial divisions 1	radial_division1	int	
Number of circumferential divisions	circumferential_division	int	Specify when flg_silde_type=2
Number of divisions in the direction of motion	meshsize_of_motion_direction	double	Specify when flg_silde_type=1
Multiple slide flags	flg_multi_slide	int	=0: Multiple slides are not used. =1: Multiple slides are used.
Set flag automatically	flg_silde_auto_setting	int	=0: Do not set automatically =1: Set the step condition automatically from the motion condition and the number of divisions around the circumference

Item name	Parameter name	Type	Description
Coordinate system ID	coordinate_system_for_slide_plane	int	Coordinate system ID to specify the normal direction on the slide plane

Parameters for the mesh generation method

Mesh generation method flag for 2D model	mg2d_type	int	=0: Automatic =1: Method in JMAG-Studio 9.0 =1: Method 1 (method for version 10.2 and earlier) (JMAG-Designer only) =2: Method 2 (method for version 10.3 and earlier) (JMAG-Designer only)
Mesh generation method flag for 3D model	mg3d_type	int	=0: Auto mesh =1: Method in JMAG-Studio 9.0 =2: Semi auto mesh =3: Extruded mesh
	flg_prioritise_extrusion	int	=0: =1:
Flag for automatic subdivide for the boundary face of a model	flg_node_insertion_on_surface	int	Use if mg3d_type=2 = 0: Do not use the automatic subdivide function for the boundary face of a model = 1: Use the automatic subdivide function for the boundary face of a model

Parameters for air region

Auto-generation flag of air region	flg_air_region_generation	int	=0: Do not create =1: Create
Flag for setting element size of air region automatically	flg_auto_set_air_mesh_size	int	=0: OFF =1: ON
Air element size[m]	air_meshsize	double	
Length ratio of air region	air_region_scale	double	
Height of air region	height_of_air_region	double	

Item name	Parameter name	Type	Description
Maintaining an existing sketch	flg_mg_target	int	JMAG-Designer only =0: Regenerate all mesh =1: Maintain existing mesh in the parts area and regenerate mesh in the air region
Fill Skew Gap	flg_mg_skewgap_filling	int	JMAG-Designer only =0: Do not fill skew gap =1: Fills skew gap
Post output flag in air region	flg_io_air_region	int	
Element size (Extrusion direction)			
Flag for setting mesh size automatically (Extruded direction)	flg_meshsize_of_extrusion_direction	int	=1 : Not automatic =0: Automatic
Element size for extrusion direction	meshsize_of_extrusion_direction	double	
Set extruded air region mesh automatically	flg_air_meshsize_of_extrusion_direction	int	=1 : Not automatic =0: Automatic
Element size for extrusion direction (Air region	air_meshsize_of_extrusion_direction	double	
Parameters for adaptive mesh			
Adaptive flag	flg_adaptive	int	=0: OFF =1: ON
Permissible error range	permissible_error	double	Used for a mesh generator.
Limit of stage numbers	adaptive_max_iteration	int	
Limit of number of mesh per stage	adaptive_simple_calc_max_iteration	int	
Flag for calculating nodal force accurately	flg_nodel_average	int	=0: OFF =1: ON

Item name	Parameter name	Type	Description
Flag for leaving the result in each stage	flg_io_adaptive_temporary_file	int	=0: OFF =1: ON

Parameters for modifying soled (JMAG-Designer)			
Number of Healing Iterations	healing_number	int	Select from 0 to 5 times
Method to determinate connection with part	flg_contact_recognition_type	int	=0: Automatic =1: General method =2: Easy method

A-4. Setting Conditions (condition_data)

- **SkinDepth**

In the SkinDepth, the items related to Skin depth are set (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Number of layers in the skin depth	num_division	int	
Skin Depth (m)	skin_depth	double	

- **LayerMesh**

In the LayerMesh, the items related to Layered mesh are set (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Thickness (m)	thickness	double	
Layers	number_of_division	int	
Lamination Factor	lamination_factor	double	
Material ID for magnetic steel sheet region	steel_sheet_material	int	
Material ID for insulation area	insulation_material	int	

- **ThinShell**

In the ThinShell, the items related to the Thin Shell Mesh are set (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Thickness (m)	depth	double	
Number of layers in a thin shell	num_division	int	

- **PartRelation**

In the PartRelation, the items related to PartRelation are set (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	int	
Copy Type	relation_type	int	=0: Translation
			=1: Rotation
Point on the rotation axis	origin	point	Specify point
Axis direction	axis	point	Specify component.

- **CopyMeshManual**

In the CopyMeshManual block, a mesh can be created for the geometry symmetry. Specify the details for creating the mesh or the symmetry of the geometry. (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Gap type	gap_type	int	=0: Radial gap
			=1: Axial gap
Inner circle: Point on axis	inner_origin	point	
Inner circle: Axis direction	inner_axis	point	

Item name	Parameter name	Type	Description
Inner circle: Reference	inner_direction	point	
Inner circle: Pattern angle [deg]	inner_pattern_angle	double	
Inner circle: Start position [deg]	inner_start_angle	double	
Inner circle: Mirror symmetry	inner_mirror_copy	int	=0: No mirror symmetry =1: Mirror symmetry
Inner circle: Target area for radius of inner diameter	inner_inside_radius	double	
Inner circle: Target area for radius of outer diameter	inner_outside_radius	double	
Inner circle: Target area for height of lower limit	inner_lower_bound	double	
Inner circle: Target area for height of upper limit	inner_upper_bound	double	
Inner circle: Element size	inner_element_size	double	
Inner circle: Expand target region to air region	inner_air_region_copy	int	=0: Do not expand =1: Expand
Outer circle: Point on the rotation axis	outer_origin	point	
Outer circle: Rotation axis direction	outer_axis	point	
Outer circle: Reference	outer_direction	point	

Item name	Parameter name	Type	Description
Outer circle: Pattern angle [deg]	outer_pattern_angle	double	
Outer circle: Start position [deg]	outer_start_angle	double	
Outer circle: Mirror symmetry	outer_mirror_copy	int	=0: No mirror symmetry
			=1: Mirror symmetry
Outer circle: Target area for the outer diameter of the radius	outer_inside_radius	double	
Outer circle: Target area for the diameter of the outer radius	outer_outside_radius	double	
Outer circle: Target area for height of lower limit	outer_lower_bound	double	
Outer circle: Target area for height of upper limit	outer_upper_bound	double	
Outer circle: Element size	outer_element_size	double	
Outer circle: Expand target region to air region	outer_air_region_copy	int	=0: Do not expand
			=1: Mirror symmetry

- **CopyMeshAuto**

In the CopyMeshAuto block, a mesh can be created for the geometry symmetry. JMAG automatically determines the geometry of the symmetry (JMAG-Designer only)

Item: None

- **DefeatureHole**

Specifies the defeature (hole) in the DefeatureHole block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Maximum radius (mm)	max_diameter	double	
Spherical surface is included in the defeature	spherical_hole	int	Available when a 3D model is selected =0: Not included =1: Included

- **DefeatureBlend**

Specifies the defeature (fillet) in the DefeatureBlend block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Maximum radius (mm)	max_radius	double	
Maximum angle (deg)	max_angle	double	
Number of samples	num_curvature_samples	double	Available when a 3D model is selected

- **DefeatureChamfer**

Specifies the deafeature (chamfer) in the DefeatureChamfer block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Maximum chamfer width (mm)	max_width	double	
Maximum angle (deg)	max_angle	double	

- **MeshMorphingLinear**

Specifies morphing (linear displacement) in the MeshMorphingLinear block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Displacement	displacement	double	
Moving direction	direction	point	Specify component

- **MeshMorphingRadial**

Specifies morphing (radial direction) in the MeshMorphingRadial block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Displacement	displacement	double	
Fixed center axis	flg_fix_axis	int	=0: Not fixed =1: Fixed
Center axis is specified	flg_use_axis	int	=0: Not fixed =1: Fixed
Point on center axis	origin	point	Specify when flg_use_axis=1
Axis direction	axis	point	Specify when flg_use_axis=1 and 3D
Moving direction	direction	point	Specify component.

- **ExtrusionDirection**

Specifies extrusion direction in the ExtrusionDirection block (JMAG-Designer only). This parameter can only be used for 3D analysis.

Item name	Parameter name	Type	Description
Condition name	condition_title	string	
Extrusion direction	extrusion_direction	point	

Appendix B. JCF File Format (Magnetic Field Analysis)

This chapter describes various parameters that can be edited using a JCF file.

B-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

▶▶ Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:

-Target (Element ID, etc.)

-Type of item to be applied (Element face or nodal point, etc.)

-Contents of point sequence data used under conditions or material characteristics

B-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	common	Controls parameters related to the entire analysis.(P. 59)
condition_data	Control	Controls parameters for analysis control (study properties).(P. 61)
	Step	Controls parameters for step control or frequency control.(P. 68)
	CyclicBoundary	Controls parameters for periodic boundary condition.(P. 69)
	SymmetryBoundary2D	Controls parameters for symmetry boundary condition (2D).(P. 69)
	SymmetryBoundary3D	Controls parameters for symmetry boundary condition (3D).(P. 69)
	FixA3D	Controls parameters for gap flux boundary condition.(P. 70)
	CurrentCtrl	Controls parameters for current condition.(P. 70)
	CurrentDensity	Controls parameters for current density condition.(P. 72)
	FEMCoil	Controls parameters for FEM coil condition.(P. 73)
	Coil_in_FEMCoil	Controls parameters for each coil region for a FEM coil condition.(P. 73)
	FEMCoilGroup	Controls parameters for group (FEM) function.(P. 73)
	FEMConductor3D	Controls parameters for FEM conductor condition.(P. 74)
	Coil_in_FEMConductor3D	Controls parameters for each conductor region of a FEM conductor condition.(P. 74)
	FEMConductorGroup	Controls parameters for group (FEM conductor) function (P. 74)/
	Force	Controls parameters for electromagnetic force condition/torque condition (P. 75).
	Flux	Controls parameters for flux condition (P. 75).
	Motion	Controls parameters for motion condition(P. 76).

Block name		Description
	Damper in Motion	Controls parameters related to attenuation constant when using the equation of motion in motion condition.(P. 80)
	Spring in Motion	Controls parameters related to spring constant when using the equation of motion in motion condition.(P. 80)
	Slide	Controls parameters for slide condition.(P. 80)
	ExternalField	Controls parameters for external field condition.(P. 81)
	StressDistribution	Controls parameters for stress distribution condition.(P. 81)
	TemperatureDistribution	Controls parameters for temperature distribution condition.(P. 82)
	Displacement	Controls parameters for displacement condition.(P. 82)
	PermanentMagnet	Controls parameters for magnetization direction of permanent magnet.(P. 82)
	Anisotropy	Controls parameters to define anisotropy for steel sheet material.(P. 84)
	LineElementType	Controls parameters for circuit component.(P. 86)
	VoltageFunction	Controls X-axis type for electric potential source (1 terminal) component and voltage source (2 terminals).(P. 90)
	VoltageFunctionDerive	Controls parameters for electric potential source (1 terminal) component and voltage source (2 terminals).(P. 91)
	CurrentFunction	Controls X-axis type of current source component.(P. 92)
	CurrentFunctionDerive	Controls parameters for current source component.(P. 92)
	Magnetization	Manages parameters for magnetization function for permanent magnet.(P. 94)
	MagnetizationDerive	Manages parameters for magnetization function for permanent magnet.(P. 94)
	CoilInductance	Manages parameters for coil inductance calculation tool.(P. 95)
	SpeedDef	Manages parameters for SPEED Link.(P. 96)
	Part_in_PartialInductance	Manages parameters for partial inductance condition.(P. 96)

Block name		Description
	BusbarInductanceParametric	Manages parameters for busbar inductance calculation tool.(P. 96)
	Ironloss	Controls parameters for iron loss analysis.(P. 97)
	Insulation	Controls parameters for insulation condition.(P. 98)
	GapElement	Controls parameters for gap condition.(P. 98)
	Element_in_Subcycling	Controls parameters for relation between components and each condition in subcycling condition.(P. 99)
	Parameters_in_Subcycling	Controls parameters for components in subcycling condition and each condition that are related.(P. 99)
	ExternalCircuitCouple	Controls parameters for external circuit link condition.(P. 100)
	Psim_in_ExternalCircuitCouple	Controls parameters for external circuit link condition.(P. 100)
	ThermalSourceCalculation	Controls parameters for heat source condition.(P. 101)
	FrozenPermeability	Controls parameters for frozen permeability condition.(P. 101)
	PartialModel	Controls parameters for partial model condition.(P. 102)
	CutPlaneAnalysis	Controls parameters for section analysis.(P. 103)
material_data	MATERIAL	Controls parameters for material.(P. 105)
	IronlossMaterial	Controls parameters for materials in iron loss analysis.(P. 113)

B-3. Basic Information of Analysis (control_parameters)

- **common**

In a common module, the item common to all analyses that are executed in JMAG is specified.

Item name	Parameter name	Type	Description
Analysis name	title	string	
Version No. of JMAG	version	int	
Solver ID	Solver_id	int	=0: 3D static magnetic field analysis (ST (3D))
			=1: 3D frequency response magnetic field analysis (FQ (3D))
			=2: 3D transient response magnetic field analysis (TR (3D))
			=3: 2D magnetic field transient analysis (DP (2D))
			=4: 2D axis symmetric magnetic field analysis (DP (AX))
			=11: 2D frequency response magnetic field analysis (FQ (2D))
			=12: 2D axis symmetric frequency response magnetic field analysis (FQ (AX))
			=13: 2D static magnetic field analysis (ST (2D))
			=14: 2D axis symmetric static magnetic field analysis (ST (AX))
			=16: Iron loss analysis * Added from version 8.3: Iron loss calculation is executed independently.
Unit label	unit_label	string	
Shape unit of data	unit_input	double	
Confirmation unit of result	unit_output	double	
Restart flag	restart	int	=0: Normal run
			=1: Restart

Item name	Parameter name	Type	Description
Parallel computing usage flag	flg_multi_cpu	int	=0: Do not use parallel computing =1: Parallel computing with shared memory multiprocessor (SMP) =2: Parallel computing with distributed memory multiprocessor (DMP)
Degree of parallelism	multi_cpu	int	Degree of parallelism * The number of licenses is determined by the degree of parallelism. *The degree of parallelism needs to be specified if flg_multi_cpu=1 or 2.
Parallel computing solver type	flg_multi_iccg_localized	int	Always 1
Split size of result file [MByte]	max_plot_size	int	
PLOT file output mode	plot_mode	int	=0: ASCII PLOT file =1: Binary PLOT file

B-4. Setting Conditions (condition_data)

- **Control**

In Control, the items of analytic control conditions are specified.

Item name	Parameter name	Type	Description
Parameters for the calculation method			
Selection flag of matrix solver	linear_solver_type	int	=0: Direct method (FEM + BEM) =2: Iterative method (FEM)
Parameters for the full model conversion			
Model thickness [m]	model_thickness	double	* Valid only for 2D analysis.
Height-specified flag of FEM coil	flg_fem_coil_height	int	=0: The height of an FEM coil is the same as model thickness. =1: The height of an FEM coil differs from model thickness.
Height of FEM coil [m]	fem_coil_height	double	* Valid only for 2D analysis.
Full model conversion flag	flg_full_model_conversion	int	=0: Not converted. =1: Converted. * The conversion factor is automatically discriminated based on periodic boundary conditions.
Conversion factor (except cyclic boundary conditions)	divide_multiplier	double	* For a 1/n model, the output value is n times.
Parameters for the solver control			

Item name	Parameter name	Type	Description
Restart type	restart_type	int	=0: Normal run =1: Execution using restart file. =2: Restart from frequency response analysis. =3: Restart during static analysis (or frequency response analysis) and use of a patch mesh. =4: Restart during transient response analysis and use of a patch mesh. =5: Steady-State Approximate Transient Analysis * Transient response analysis only
Model type flag of Steady-state approximate transient analysis	flg_use_slip_frequency	int	=0: Stationary Device =1: Induction Motor
Slip [%]	pseudo_steady_slip	double	Use when flg_use_slip_frequency=1
Snapshot calculation usage flag	flg_snap_shot	int	=0: Snapshot calculation is not executed. =1: Snapshot calculation is executed.
Number of retry times	retry	int	Specify what time to retry when calculation failed during snapshot calculation.
Calculation mode of retry	calc_mode	int	=0: Only calculation which went wrong is re-performed. =1: All calculations are redone.
Number of step divisions of snapshot calculation	num_div_step_for_snap_shot	int	
Using GPU flag	flg_use_gpu	int	=0: Do not use GPU =1: Use GPU
Time periodic explicit error correction flag	flg_tpeec	int	=0: Do not correct =1: Correct
Periodicity of time periodic explicit error correction	tpeec_periodic_type	int	=1: Antiperiodic =2: Periodic
Flag to reverse correction type for the rotor	flg_reverse_periodic_type_rotor	int	=0: Do not reverse correction type for the rotor =1: Use reverse correction type for the rotor

Item name	Parameter name	Type	Description
Use relaxation factor	tpeec_use_nonlin_reduction	int	=0: Do not use relaxation factor
			=1: Use relaxation factor
Specify method for time periodic explicit error correction timing	tpeec_setting_type	int	=0: Frequency
			=1: Interval
Correction frequency	tpeec_frequency	double	
Correction interval	tpeec_step_div	int	
Max. Corrections	tpeec_max_num_correction	int	

Parameters for the circuit conversion

Circuit conversion flag	flg_circuit_conversion	int	=0: Do not convert
			=1: Convert (periodic boundary)
			=2: Convert (series/parallel)
Conversion factor of circuit (except cyclic boundary conditions)	circuit_divide_multiplier	double	* For a 1/n model, the parameter is n times or 1/n.
Circuit connction	circuit_connect_information	int	=0: Serius
			=1: Parallel
			=2: Parallel and Anti-Periodic
Number of series connections	series_number	double	Use when flg_circuit_conversion=2
Number of parallel connections	parallel_number	double	Use when flg_circuit_conversion=2

Item name	Parameter name	Type	Description
Parameters for the ICCG			
ICCG default value usage flag	iccg_default_gu i	int	=0: A default value is not used. =1: A default value is used.
Automatic determination flag of ICCG acceleration coefficient	flg_auto_accel	int	=0: Specified. =1: Determined automatically.
ICCG acceleration coefficient	iccg_accel	double	
ICCG convergence tolerance flag during nonlinear calculation	iccg_tolerance_type	int	=1: Automatic setting at each step based on the set reference value (default) =2: A constant value is used throughout (uses the iccg_tolerance value) =3: Manual setting of value at each step (previously known, step control)
Maximum number of ICCG convergence tolerance during nonlinear calculation	iccg_init_tolera nce	double	Set when iccg_tolerance_type=1
Minimum number of ICCG convergence tolerance during nonlinear calculation	iccg_min_toler ance	double	Set when iccg_tolerance_type=1
ICCG convergence tolerance	iccg_tolerance	double	
ICCG calculation tolerance	iccg_max_toler ance	double	
Maximum number of ICCG iterations	iccg_max_iterat ion	double	
Optimum value usage flag during non-convergence	flg_iccg_optim um_value	int	=0: Not used =1: Used
ICCG restart flag	flg_iccg_restart	int	=0: Not used =1: Used

Item name	Parameter name	Type	Description
Calculation method (A-phi method) flag	flg_a_phi_method	int	=0: Use A-phi method =1: Use A-phi method 1 (versions before JMAG-Studio version 9.1 and JMAG-Designer version 5.0.) =2: Use A-phi method 2
Parameters for the nonlinear calculation			
Maximum number of nonlinear calculation iterations	nonlinear_max_iteration	double	
Iterative tolerance of nonlinear calculation	nonlinear_convergence_tolerance	double	
Iterative method flag of nonlinear calculation	nonlinear_method_type	int	=0: Newton-Raphson method =1: Successive iteration method
Relaxation factor flag during use of Newton-Raphson method	ralaxation_factor_type	int	=0: Not used. =1: Relaxation factor 1 (Two-division search type) =2: Relaxation factor 1 (Residual minimum search type)
Convergence determination change flag of nonlinear calculation	flg_iccg_strict_convergence	int	=0: Normal =1: Judged strictly
Flag for using speed-up analysis scheme	flg_nonlinear_speeding_up	int	=0: Do not use speed-up analysis scheme =1: Use speed-up analysis scheme
Flag for the correction of BH curve for frequency response analysis	flg_fq_bh_correct	int	=0: Do not correct =1: Correct
Parameters for output settings			
Output flag of stored energy	flg_io_energy	int	=0: Not output =1: Output
Output flag of magnetic flux density	flg_io_magnetic_flux_density	int	=0: Not output =1: Output * Output for each element.

Item name	Parameter name	Type	Description
Output flag of magnetization / magnetic field	flg_io_magnetization	int	=0: Not output =1: Output * Output for each element.
Current density output flag	flg_io_current_density	int	=0: Not output =1: Output * Output for each element.
Current (beam) output flag	flg_io_current_o n_beam	int	=0: Not output =1: Output * Output for each external field beam element
Output flag of Joule loss density	flg_io_loss_density	int	=0: Not output =1: Output * Output for each element.
Output flag of surface force density	flg_io_surface_force_density	int	=0: Not output =1: Output * Output for each element surface or element edge.
Output flag of Lorentz force density	flg_io_lorentz_force_density	int	=0: Not output =1: Output * Output for each element.
Output flag of electric field	flg_io_electric_field	int	=0: Not output =1: Output * Output for each element.
Output flag of permeance_factor	flg_io_permeance_factor	int	=0: Not output =1: Output
Output flag of displacement	flg_io_nodal_displacement	int	=0: Not output =1: Output * Output for each node.
Output flag of vector potential	flg_io_vector_potential	int	=0: Not output =1: Output * Output for each node.
Output flag of nodal force	flg_io_nodal_force	int	=0: Not output =1: Output * Output for each node.
Output flag of permeability	flg_io_permeability	int	=0: Not output =1: Output
Output flag of differential permeability	flg_io_differential_permeability	int	=0: Not output =1: Output

Item name	Parameter name	Type	Description
Output flag of stress	flg_io_stress	int	=0: Not output =1: Output
Save file output flag	flg_io_save_file	int	=0: Not output =1: Output
Convergence status output flag of iterative linear solver	flg_io_convergence	int	=0: Not output =1: Output
Output interval type	output_timing_mode	int	=0: Output all steps =1: Output from specified step to last step =2: Use output interval table
First output step	output_timing_start_step	int	For output_timing_mode = 1

Parameters for coupled analysis

Two way coupled analysis flag	coupled_heat	int	=0: Normal run =1: Two way coupled analysis =2: Two way coupled analysis Multiple magnetic field steps are executed by TR. Averaged by loss. Can be used from version 8.3 or later.
	coupled_remesh_type	int	=0: =1:

Parameters for user subroutine

User subroutine Dll	usrsub_name	string	User subroutine dll name (With no extension)
Usage flag of subroutine “hsusrl.f”	flg_hsusr1	int	=0: Disables the hsusr1.f option =1: Enables the hsusr1.f option
Usage flag of subroutine “hsusr2.f”	flg_hsusr2	int	=0: Disables the hsusr2.f option =1: Enables the hsusr2.f option
Usage flag of subroutine “hsusr3.f”	flg_hsusr3	int	=0: Disables the hsusr3.f option =1: Enables the hsusr3.f option
Usage flag of subroutine “hsusr4.f”	flg_hsusr4	int	=0: Disables the hsusr4.f option =1: Enables the hsusr4.f option
Usage flag of subroutine “usrfle.f”	flg_usrfle	int	=0: Disables the usrfle.f option =1: Enables the usrfle.f option

Item name	Parameter name	Type	Description
Usage flag of subroutine "usrstp.f"	flg_usrstp	int	=0: Disables the usrstp.f option
			=1: Enables the usrstp.f option
Usage flag of subroutine "usrlos.f"	flg_usrlos	int	=0: Disables the usrlos.f option
			=1: Enables the usrlos.f option
Usage flag of subroutine "usrhys.f"	flg_usrhys	int	=0: Disables the usrhys.f option
			=1: Enables the usrhys.f option
Usage flag of subroutine "usrfm2.f"	flg_usrfm2	int	=0: Disables the usrfm2.f option
			=1: Enables the usrfm2.f option
Subroutine "husrstr.f" flag	flg_usrstr	int	=0: Not use
			=1: Use
Selection flag of magnetizing process calculation	flg_magnetization_process	int	=0: Not performed
			=1: Performed
User array size	usub_array_size	int	

- **Step**

In Step, the items of step conditions are specified.

Item name	Parameter name	Type	Description
Number of analysis steps	num_analysis_step	int	
Analysis start step	analysis_start_step	int	Analysis start step for snapshot calculation * Do not modify this setting from "1".
Step type	step_type	int	=1: Time specification or regular interval division
			=2: Time specification of separate section at regular interval
			=3: Constant value time (for DLL)
			=4: Displacement specification (Can be used when the motion equation of displacement specification is used under motion conditions.)
Number of divisions	step_division	int	* Can be used only for step_type = 1.
Time point sequence table number	step_table_gui	int	
Time table name	step_table_name_gui	string	

Item name	Parameter name	Type	Description
Displacement per step	movement_quantity	double	* Can be used only for step_type = 4.
Maximum elapsed time [sec]	elapse_maximum_time	double	* Can be used only for step_type = 4.

- **CyclicBoundary**

In CyclicBoundary, the items of periodic boundary conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Boundary type	cyclic_type	int	=+1: Rotation periodicity =+2: Translational periodicity =+3: Axial reverse rotational periodicity <0: Anti-periodic boundary =-1: Rotation periodicity =-2: Translational periodicity
A point on rotation axis	origin	point	* Specified for each component.
Direction of rotation axis	axis_vector	point	* Specified for each component.
Periodic angle or distance	angle	double	Periodic angle for rotational periodicity [deg] Periodic distance for translational periodicity [m]

- **SymmetryBoundary2D**

In SymmetryBoundary2D, the item of symmetry boundary 2D conditions is specified.

Item name: None

- **SymmetryBoundary3D**

In SymmetryBoundary3D, the item of symmetry boundary 3D conditions is specified.

Item name: None

- **FixA3D**

The gap flux boundary condition is specified for FixA3D block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition ID	id	int	
Result file for magnetic field analysis that is referred	file_referred_plot_file_ml	string	* Specify absolute path
Start step (for FFT)	start_step	int	
End step (for FFT)	end_step	int	
Frequency degree (for FFT)	order_of_frequency	int	
Flag for permeability using 2D analysis result	flg_myu_mapping	int	=0: Result not used =1: Result used

- **CurrentCtrl**

In CurrentCtrl, the items of current conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
inflow face/vector-specified flag	flowin_type	int	=0: Element face is specified. =1: Vector is specified.
Vector start point	flowin_origin	point	Specified for each component. Can be used only for flowin_type = 1.
Current flowing direction of vector	flowin_vector	point	Specified for each component. Can be used only for flowin_type = 1.

Item name	Parameter name	Type	Description
X-axis type	x_type	int	=1: Time [sec] (Static analysis and transient response analysis)
			=1: Frequency [Hz] (Frequency response analysis)
			=2: Rotation angle
			=3: X-axis direction
			=4: Y-axis direction
			=5: Z-axis direction
			=6: Step number
			=7: Time [sec] (Frequency response analysis)
			=8: Displacement in motion direction
Function type	function_type	int	=0: Point sequence
			=1: Sinusoidal function
			=2: Exponential function
			=3: Constant value
Eddy current flag	flag_eddy	int	=0: An eddy current is not generated.
			=2: An eddy current is generated.
Constant value [A]	constant_current	double	
Current point sequence table number	current_table_gui	int	
Current point sequence table name	current_table_name_gui	string	
Cyclic flag of point sequence	flag_cyclic	int	=0: Periodic
			=1: Not periodic
Amplitude [A]	amplitude	double	
Frequency [Hz]	frequency	double	
Phase [deg]	phase	double	
Asymptotic value [A]	initial_value	double	
Time constant [sec]	time_constant	double	
Number of turns	turn	double	
Eddy current flag	flag_eddy	int	=0: An eddy current is not generated.
			=2: An eddy current is generated.

- **CurrentDensity**

In CurrentDensity, the items of current density conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
X-axis type	x_type	int	=1: Time
			=2: Rotation angle
			=3: X-axis direction
			=4: Y-axis direction
			=5: Z-axis direction
			=6: Step number
			=8: Displacement in motion direction
Function type	function_type	int	=0: Point sequence
			=1: Sinusoidal function
			=2: Exponential function
			=3: Constant value
Constant value [A/m2]	constant_density	double	For density_type = 1, the unit is [A].
Current density point sequence table number	density_table_gui	int	
Current density point sequence table name	density_table_name_gui	string	
Cyclic flag of point sequence	flag_cyclic	int	=0: Periodic
			=1: Not periodic
Amplitude [A/m^2]	amplitude	double	For density_type = 1, the unit is [A].
Frequency [Hz]	frequency	double	
Phase [deg]	phase	double	
Asymptotic value [A/m^2]	initial_value	double	For density_type = 1, the unit is [A].
Time constant [sec]	time_constant	double	
Eddy current flag	density_type	int	=0: An eddy current is not generated.
			=1: External current (Only 3D)
			=2: An eddy current is generated.

- **FEMCoil**

In FEMCoil, the items of FEM coil conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Reference ID table	coil_id_table	int	
Z-direction length	coil_zlength	double	Can be used only for 2D analysis. Must be the same value as for analytic control.
FEM coil group name	fem_coil_name_gui	string	

- **Coil_in_FEMCoil**

In Coil_in_FEMCoil block, the items for each coil region in FEM coil conditions can be specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Name of FEM coil region	coil_name	string	
Current flowing direction-specified flag	flowin_type	int	=0: inflow face specification * 3D =0: Inflow direction down * 2D =1: Vector specification * 3D =1: Inflow direction up * 2D
Start point	flowin_origin	double	Specified for each component. Can be used only for flowin_type = 1.
Current flowing direction	flowin_vector	double	Specified for each component. Can be used only for flowin_type = 1.

- **FEMCoilGroup**

In FEMCoilGroup block, the group (FEM coil) conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	name	int	

- **FEMConductor3D**

In FEMConductor3D, the items of FEM conductor conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Name of FEM conductor region	fem_cond_name_gui	string	
Series number	series_number	double	
Parallel number	parallel_number	double	

- **Coil_in_FEMConductor3D**

In Coil_in_FEMConductor3D block, the items for each conductor region in FEM conductor conditions can be specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Name of FEM conductor region	cond_name	string	
Current flowing direction-specified flag	direction	int	=-1: Not used * 3D =0: Up *2D =0: +Theta *Axialsymmetry =1: Down *2D =1: -Theta *Axialsymmetry

- **FEMConductorGroup**

In FEMConductorGroup block, the group (FEM conductor) conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	name	int	

- **Force**

In Force, the items of calculation conditions for electromagnetic force and torque are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Flag for calculating torque	flg_io_torque	int	=0: Not calculated.
			=1: Calculated. * A torque axis must be set.
A point on torque actioned axis	origin	point	Specified for each component.
Torque axis vector	axis_vector	point	Specified for each component.
Calculation method flag	force_calc_type	int	=1: Surface force method (Maxwell stress method)
			=2: Nodal force method
			=3: Lorenz force
Cooperation flag with external simulator	flg_external	int	=0: Not cooperate with an external circuit simulator.
			=1: Cooperates with an external circuit simulator.

- **Flux**

In Flux, the item of calculation conditions for magnetic flux is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Direction	flg_direction	int	=1: The outflow direction is positive
			=-1: The inflow direction is positive

- **Motion**

In Motion, the items of motion conditions are specified.

<table>
<tr><th>Item name</th><th>Parameter name</th><th>Type</th><th>Description</th></tr>
<tr><td>Condition ID</td><td>id</td><td>int</td><td></td></tr>
<tr><td rowspan="10">Definition/parame-ter/ specification method</td><td rowspan="10">motion_type</td><td rowspan="10">int</td><td>=0: Displacement specification x Velocity x Point sequence</td></tr>
<tr><td>=1: Displacement specification x Step dis-tance x Point sequence</td></tr>
<tr><td>=2: Displacement specification x Cumula-tive Distance x Point sequence</td></tr>
<tr><td>=3: Specifies the equation of motion x time and calculates the distance.</td></tr>
<tr><td>=4: Displacement specification x Velocity x Constant value</td></tr>
<tr><td>=5: Displacement specification x Step dis-tance x Constant value</td></tr>
<tr><td>=6: Specifies the equation of motion x dis-tance and calculates the time.</td></tr>
<tr><td>=7: Displacement specification x Velocity x Constant value</td></tr>
<tr><td>=8: Displacement specification x Cumula-tive distance x Constant value</td></tr>
<tr><td>= Negative integer: A user subroutine is used.</td></tr>
<tr><td rowspan="3">Type of movement range</td><td rowspan="3">flg_array_rang e_type</td><td rowspan="3">int</td><td>Can be used except when motion_type is 3 and 6.</td></tr>
<tr><td>=1: Rotation</td></tr>
<tr><td>=2: Translation</td></tr>
<tr><td rowspan="3">Movement direction</td><td rowspan="3">flg_motion_di rection</td><td rowspan="3">int</td><td>Can be used when motion_type is 3 and 6.</td></tr>
<tr><td>=0: Translation</td></tr>
<tr><td>=1: Rotation</td></tr>
<tr><td>A point on rotation axis</td><td>origin</td><td>point</td><td>Specified for each component.</td></tr>
<tr><td>Direction of rotation axis/Direction of motion</td><td>axis_vector</td><td>point</td><td>Specified for each component.
Direction of rotation axis
(when flg_array_range_type=1, or flg_motion_direction=1).
Direction of motion
(when flg_array_range_type=2).</td></tr>
</table>

Item name	Parameter name	Type	Description
Direction of motion	motion_direction	point	Direction of motion (when flg_motion_direction=0).
Initial position of moving part ([m] or [deg])	initial_displacement	point	For rotation, uses the first component to output the angle [deg]. For translation, outputs the displacement [m] of XYZ.
Cooperation flag with external simulator	flg_external	int	=0: Cooperates. =1: Not cooperate.
Displacement flag of mesh	flag_vxb	int	=0: Accompanied by mesh displacement. =1: Not accompanied by mesh displacement.

Point sequence name	motion_table_name_gui	string	
Point sequence number	motion_table_id_gui	int	
Point sequence or constant value	motion_table	double	Velocity point sequence for motion_type =0 Distance point sequence for motion_type per step=1 Cumulative distance point sequence for from initial position for motion_type=2 Constant distance value for motion_type =5 Constant velocity value for motion_type =7 Constant cumulative distance value for motion_type =8
Cyclic flag of point sequence	flag_cyclic	int	=0: Periodic =1: Not periodic

Number of “electromagnetic force and torque calculation” condition to be referenced	fma_force_id	int	Can be used for motion_type = 3 or 6. =0: When electromagnetic force and torque are not referenced.
	multiplier	double	

Item name	Parameter name	Type	Description
Load type (equation of motion)	load_type	int	=0: Constant load =1: Constant load versus time table =2: Constant load versus angle table (Rotation motion) =3: Constant load versus time table (Translation motion) =4: Constant load versus displacement table
Constant load such as gravity [N]	load_force	double	Used for flg_motion_direction = 0.
Cyclic flag of load table (equation of motion)	flg_load_cyclic	int	=0: Periodic =1: Not periodic
Mass [kg]	mass	double	
	flg_mass_factor	int	
	mass_factor	double	
	flg_mass_offset	int	
	mass_offset	double	
Initial position ([m] or [deg])	initial_position	double	
Initial velocity ([m/sec] or [deg/sec])	initial_velocity	double	
Initial position + Positive upper limit of displacement	max_position	double	
Initial position + Negative upper limit of displacement ([m] or [deg])	min_position	double	

Item name	Parameter name	Type	Description
Static friction coefficient (equation of motion)	static_friction	double	
Dynamic friction coefficient (equation of motion)	kinetic_friction	double	
Constant value of normal force (equation of motion)	normal_reaction	double	
Radius from the normal force acting point (equation of motion)	friction_radius	double	* Rotation motion
Flag for allow electromagnetic force (equation of motion)	flg_friction_force	int	=0: Do not allow =1: Allow
Normal direction specified flag	direction_type	int	=0: Specify by Y-Axis or Coordinate =1: Specify by Vector
Coordinate Id (equation of motion)	reaction_coordinate_id	int	
Normal direction with respect to the friction	reaction_vector	double	

Eccentricity flag	flg_offcenter_analysis	int	=0: Do not apply eccentricity =1: Apply eccentricity
Center of tilt of motion region [m]	model_slope_origin	double	
Tilt axis of motion region	model_slope_vector	double	
Tilt angle of motion region [deg]	model_slope	double	
Offset of motion region	model_offcenter	double	Set when flag_offcenter_analysis=1
Tilt axis of rotation axis	axis_slope_vector	double	Set when flag_offcenter_analysis=1
Tilt angle of rotation axis [deg]	axis_slope	double	Set when flag_offcenter_analysis=1

Item name	Parameter name	Type	Description
Offset of rotation axis	axis_offcenter	double	

- **Damper_in_Motion**

In Damper in Motion, the items related to the damper of motion conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Relaxation factor type	flg_function_type	int	=0: Constant
			=1: Point sequence
Attenuation constant [N/(m/sec)]	constant	double	When the expansion direction type is circumferential.

- **Spring_in_Motion**

In Spring in Motion, the items related to the spring of motion conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Spring constant type	flg_function_type	int	=0: Constant
			=1: Point sequence
Spring constant [N/m]	constant	double	When the expansion direction type is circumferential.

- **Slide**

In Slide, the item related to slide conditions is specified.

Item: None

- **Spring in Motion**

In Spring in Motion, the item related to the spring of motion conditions is specified.

Item: None

- **ExternalField**

In ExternalField, the items of external field conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
External field direction	axis_vector	double	* Specified for each component.
Magnetic flux density function type	function_type	int	=0: Point sequence =1: Sinusoidal function =2: Exponential function
Amplitude [T]	amplitude	double	Used for function_type = 1 or 2.
Frequency [Hz]	frequency	double	Used for function_type = 1.
Phase [deg]	phase	double	Used for function_type = 1.
Asymptotic value [T]	initial_value	double	Used for function_type = 2.
Time constant [sec]	time_constant	double	Used for function_type = 2.

- **StressDistribution**

In StressDistribution, the items related to stress distribution conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Setting method	type	int	=0: A structural analysis PLOT file is used. =1: Specified for each material.
Method	coupling_type	int	=0: One-way coupled analysis =1: Two-Way Coupled Analysis
File name of DS result to be referenced	ds_post_file	string	
Step ID for Abaqus result file for reference	abaqus_step	string	
Unit of displacement for Abaqus result file for reference	abaqus_unit	string	

- **TemperatureDistribution**

Specify the item for the temperature distribution condition in the Temperature-Distribution block.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Coupling type	coupling_type	int	=0: One-way coupled analysis =1: Two-way coupled analysis
Result file name of thermal analysis for referencing	reference_post_file	string	

- **Displacement**

Specify the item for the displacement condition in the Displacement block.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Coupling type	coupling_type	int	=0: One-way coupled analysis =1: Two-way coupled analysis
Result file name of structural analysis for reference	reference_post_file	string	
Step ID for Abaqus result file for reference	abaqus_step	string	
Unit of displacement for Abaqus result file for reference	abaqus_unit	string	

- **PermanentMagnet**

In PermanentMagnet, the magnetization direction of a permanent magnet is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	

Item name	Parameter name	Type	Description
Magnetization direction type	pattern_type	int	=0: Specified for each element.
			=1: Parallel or circular direction anisotropy
			=2: Radial anisotropy
			=3: Spherical anisotropy
			=4: Parallel pattern (circular direction)
			=5: Radial pattern (circular direction)
			=6: Polar anisotropy pattern (circular direction)
			=7: Axis direction pattern (circular direction)
			=8: Parallel pattern (rectilinear)
			=9: Polar anisotropy pattern (rectilinear)
Counterturn of magnetizing property	magnetization	int	=+1: Not reversed.
			=-1: Reversed.
Number of poles	num_pole	double	* Specified by 360 degrees.
Starting position theta 0 [deg]	start_position	double	
Center point [m]	shift_center_in_local	double	* Specified for each coordinate.
Angle from X-axis [deg]	angle_from_x_axis	double	
Angle from Z-axis [deg]	angle_from_z_axis	double	
Pitch [m]	pitch	double	
Starting position R [m]	start_position	double	
Angle from X-axis in direction of row of magnet [deg]	angle_from_local_x_axis	double	
Coordinate system ID	local_coordinate_id	int	* Set to 0 when a coordinate system is not used.
A point on rotation criteria axis [m]	axis1	point	
Another point on rotation criteria axis	axis2	point	

Item name	Parameter name	Type	Description
Third-component direction rotation angle in whole coordinate system [deg]	system_angle	double	
Distance to center of cylindrical coordinate system in each pole [m]	distance_of_sub_cylinder	double	
Rising angle [deg]	range_start	double	
Decaying angle [deg]	range_end	double	
Skew flag	flg_use_skew	int	=0: Do not set skew =1: Set skew
Magnet thickness [m]	magnet_thickness	double	
Skew amount [m] or [deg]	skew_value	double	
Step skew flag	flg_use_stepskew	int	=0: Do not set step skew =1: Set step skew
Number of steps	step_number	double	

- **Anisotropy**

In Anisotropy, the anisotropy of steel sheet materials is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	

Item name	Parameter name	Type	Description
Coordinate system-specified type	coordinate_type	int	=1: Rectangular coordinate system (X direction: Rolling direction, Z direction: Lamination direction)
			=2: Cylindrical coordinate system (Theta-direction: Rolling direction, R direction: Lamination direction)
			=3: Angle from X-axis * Used for 2D analysis or axis symmetric analysis.
			=4: A user subroutine is used.
			=5: Cylindrical coordinate system (Z direction: Rolling direction, R direction: Lamination direction)
			=6: Cylindrical coordinate system (Theta-direction: Rolling direction, Z direction: Lamination direction)
			=7: Cylindrical coordinate system (R direction: Rolling direction, Z direction: Lamination direction)
			=8: Cylindrical coordinate system (R direction: Rolling direction, Theta-direction: Lamination direction)
			=9: Cylindrical coordinate system (Z direction: Rolling direction, Theta-direction: Lamination direction)
Local coordinate system number	local_coordinate_id	int	Positive number: Can be used for coordinate_type = 1 or 2.
			Negative number: Can be used for coordinate_type = 4. (Defined using a user subroutine.)
ID for user subroutine (Negative integer)	usub_number	int	Negative integer
Center point of cylindrical coordinate system [m]	shift_center_in_local	double	
Angle from X-axis [deg]	angle_from_x_axis	double	* Can be used for 2D analysis or axis symmetric analysis.

- **LineElementType**

In LineElementType, the detailed data on a circuit component is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Circuit element type	type	int	=1: FEM coil
			=2: FEM conductor
			=3: User subroutine
			=11: Reference FEM conductor
			=12: Reference FEM coil
			=-1: Resistance (Constant value)
			=-2: Capacitor
			=-3: Coil
			=-4: Switch (Time, rotation, displacement, and step dependency)
			=-5: Diode
			=-6: Supply voltage
			=-7: Supply current
			=-8: Brush element
			=-9: Three-phase voltage source
			=-10: Three-phase current source
			=-11: Resistance (Voltage dependency)
			=-12: Resistance (Current dependency)
			=-13: Resistance (Time, rotation, displace-ment, and step dependency)
			=-14: Supply voltage (2 terminals)
			=-41: Switch (Voltage dependency)
			=-42: Switch (Current dependency)
FEM coil number	group_id	int	Can be used only for type = 1.
Resistance [ohm]	coil_resistance	double	Can be used only for type = 1.
Number of turns [Turn]	coil_turn	double	Can be used only for type = 1.
FEM conductor number	group_id	int	Can be used only for type = 2.
User parameter	user_id	int	Can be used only for type = 3.

Item name	Parameter name	Type	Description
Resistor or switch type	x_type	int	Available only when the component type is switch, voltage-dependent resistance, current-dependent resistance, voltage-dependent switch or current-dependent switch, 3-phase current source, or 3-phase voltage source. In the case of 3-phase current source, or 3-phase voltage source, can be used only for type = 1, 2, 3, 4, 5, 8.
			=1: Time
			=2: Rotation angle
			=3: Displacement of X-axis direction
			=4: Displacement of Y-axis direction
			=5: Displacement of Z-axis direction
			=6: Step number
			=8: Displacement in motion direction
Resistance value [ohm]	resistance	double	Can be used only for type = -1.
Initial resistance [ohm]	initial_resistance	double	Can be used only for type = -11 and -12.
Reference terminal 1	reference_terminal_1	int	Can be used only for type = -11.
Reference terminal 2	reference_terminal_2	int	Can be used only for type = -11.
Reference circuit component number	reference_line_element	int	Can be used only for type = -12 and -42.
Cyclic flag of point sequence	flag_cyclic	int	Can be used only for type = -4, -11, -12, -41, or -42 and for switch_function_type = 1.
			=0: Periodic
			=1: Not periodic
Capacitance [F]	capacitance	double	Can be used only for type = -2.
Inductance [H]	inductance	double	Can be used only for type = -3.
Initial open/close status	initial_onoff	int	Can be used only for type = -41 and -42.
Function type	switch_function_type	int	Can be used only for type = -4, -41, and -42.
			=1: Point sequence
			=2: Parameter specification

Item name	Parameter name	Type	Description
Initial state	initial_switch_onoff	int	Can be used only for type = -4, -41, or -42 and for switch_function_type = 2. =0: OFF =1: ON
1-cycle length ([sec] and [deg])	cycle_length	double	Can be used only for type = -4, -41, or -42 and for switch_function_type = 2.
First switch ([sec] and [deg])	first_change	double	Can be used only for type = -4, -41, or -42 and for switch_function_type = 2.
Second switch ([sec] and [deg])	second_change	double	Can be used only for type = -4, -41, or -42 and for switch_function_type = 2.
Function type	diode_function_type	int	Can be used only for type = -5. =0: Point sequence =1: Logarithmic function, V(t) = K ln((Is + I(t))/Is)
Coefficient K	k_value	double	Can be used only for type = -5 and diode_function_type = 1.
Saturation current Is [A]	saturation_current	double	Can be used only for type = -5 and diode_function_type = 1.
Referenced initial voltage [V]	initial_voltage	double	Can be used only for type = -5. Used only in the first nonlinear iterative calculation of the first step.
Upper limit of impedance [ohm]	max_resistance	double	Can be used only for type = -5.
Lower limit of impedance [ohm]	min_resistance	double	Can be used only for type = -5.
Number of brush poles [deg]	num_poles	int	Can be used only for type = -8. * Even number of more than 2
Slit width of commutator [deg]	commutator_slit_width	double	Can be used only for type = -8.
Brush width [deg]	brush_width	double	Can be used only for type = -8.
Initial position [deg]	brush_position	double	Can be used only for type = -8.
Contact resistance of brush and commutator [ohm]	brush_resistance	double	Can be used only for type = -8.
Arc voltage usage flag	flg_arc_voltage	int	=0: Not used. =1: Used.
Arc voltage [V]	arc_voltage	double	

Item name	Parameter name	Type	Description
Spark starting voltage [V]	arc_start_voltage	double	
Type of three-phase AC	phase_type	int	Can be used only for type = -9 or -10.
			=0: UVW is 0, 120, and 240 degrees.
			=1: UVW is 0, -120, and +120 degrees.
Amplitude	amplitude	double	For type = -9, the unit is [V].
			For type = -10, the unit is [A].
Frequency [Hz]	frequency	double	Can be used only for type = -9 or -10.
Phase of U-phase [deg]	phase_u	double	Can be used only for type = -9 or -10.
ID of supply voltage	voltage_function_id	double	Can be used only for type = -14
Referenced FEM coil component or FEM conductor component	id_reference	int	Uses LineElementType Id of referenced FEM conductor for type = 11.
			Uses Line ElementTypeId of referenced FEM coil for type = 12
Periodicity	periodic	int	=1: Periodic
			=-1: Anti-periodic
Periodic angle [deg]	periodic_angle	double	
Periodic distance [m]	stroke	double	
Resistance type	flg_resistance_type	int	Used only when type = 1, -1, -11, -12, -13
			=0: Constant
			=1: Temperature dependent resistance point sequence
Temperature type	flg_temperature_type	int	Used only when type = 1, -1, -11, -12, -13
			=0: Constant
			=1: Time dependent temperature point sequence
Constant temperature [Celsius]	temperature	double	Constant Used only when type = 1, -1, -11, -12, -13
Thermal analysis average temperature calculation condition ID to be referenced	average_temperature_id	int	Used only when type = 1, -1, -11, -12, -13

Item name	Parameter name	Type	Description
Thermal analysis JCF file for coupled analysis	reference_jcf_file	string	Used only when type = 1, -1, -11, -12, -13
User-defined brush properties table (all brushes)	flg_use_brush_table	int	=0: Not use user-defined brush properties table
			=1: Use user-defined brush properties table
Settings for each brush	brush_setting_type	int	=0: Not use user-defined brush properties table
			=1: Use user-defined brush properties table
Brush width [deg] (each brush)	brush_width_number	double	Enter the brush ID for "number".
Brush position [deg] (each brush)	brush_position_number	double	Enter the brush ID for "number".
Contact resistance between brush and commutator bar [ohm] (each brush)	brush_resistance_number	double	Enter the brush ID for "number".
Constant or point sequence (each brush)	flg_use_brush_table_number	int	Enter the brush ID for "number".
			=0: Not use user-defined brush properties table
			=1: Use user-defined brush properties table
Number of brush divisions	brush_divide_multiplier	int	

- **VoltageFunction**

In VoltageFunction, the supply voltage component of a circuit is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Reference ID table	func_id_table	table	
X-axis type	x_type	int	=1: Time [sec]
			=2: Rotation angle [deg]
			=3: X-axis direction [m]
			=4: Y-axis direction [m]
			=5: Z-axis direction [m]
			=6: Step number
			=8: Displacement in motion direction

- **VoltageFunctionDerive**

In VoltageFunction, the detailed data on the supply voltage component of a circuit is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Function type	function_type	int	=0: Point sequence =1: Sinusoidal function =2: Exponential function =3: Constant value =4: Pulse =5: Rectangle wave function =6: Ground (0 V) =7: Cooperates with an external simulator. (Same in a function as function_type = 3.)
Start point flag	flg_effective_range_start	int	=0: The start point of an effective range is not specified. =1: The start point of an effective range is specified.
Start point (Unit example, [sec])	effective_range_end	double	
End point flag	flg_effective_range_end	int	=0: The end point of an effective range is not specified. =1: The end point of an effective range is specified.
End point (Unit example, [sec])	effective_range_start	double	
Constant value [V]	constant_voltage	double	Can be used only for function_type = 0 or 6.
Amplitude [V]	amplitude	double	Can be used only for function_type = 1, 2, 4, or 5.
Frequency [Hz]	frequency	double	Can be used only for function_type = 1, 4, or 5.
Phase [deg]	phase	double	Can be used only for function_type = 1.
Delay [sec]	delay_length	double	Can be used only for function_type = 4.
Pulse width [sec]	palse_width	double	Can be used only for function_type = 4.
Rising phase [sec]	start_length	double	Can be used only for function_type = 4.
Decaying phase [sec]	end_length	double	Can be used only for function_type = 4.
Initial value [V]	initial_value	double	Can be used only for function_type = 2.
Time constant [sec]	time_constant	double	Can be used only for function_type = 2.

Item name	Parameter name	Type	Description
Offset (Unit example, [sec])	offset_x	double	
Offset [V]	offset_voltage	double	
Point sequence periodicity	flag_cyclic	int	=0: Periodic
			=1: Not periodic

- **CurrentFunction**

In CurrentFunction, the supply current component of a circuit is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
X-axis type	x_type	int	=1: Time [sec]
			=2: Rotation angle [deg]
			=3: X-axis direction [m]
			=4: Y-axis direction [m]
			=5: Z-axis direction [m]
			=6: Step number
			=8: Displacement in motion direction

- **CurrentFunctionDerive**

In CurrentFunctionDerive, the detailed data on the supply current component of a circuit is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Function type	function_type	int	=0: Point sequence
			=1: Sinusoidal function
			=2: Exponential function
			=3: Constant value
			=4: Pulse
			=5: Rectangle wave function
			=6: Ground (0V)
			=7: Cooperates with an external simulator. (Same in a function as the constant value.)

Item name	Parameter name	Type	Description
Start point flag	flg_effective_range_start	int	=0: The start point of an effective range is not specified.
			=1: The start point of an effective range is specified.
Start point (Unit example, [sec])	effective_range_end	double	
End point flag	flg_effective_range_end	int	=0: The end point of an effective range is not specified.
			=1: The end point of an effective range is specified.
End point (Unit example, [sec])	effective_range_start	double	
Constant value [A]	constant_voltage	double	Can be used only for function_type = 0 or 6.
Amplitude [A]	amplitude	double	Can be used only for function_type = 1, 2, 4, or 5.
Frequency [Hz]	frequency	double	Can be used only for function_type = 1, 4, or 5.
Phase [deg]	phase	double	Can be used only for function_type = 1.
Delay [sec]	delay_length	double	Can be used only for function_type = 4.
Pulse width [sec]	palse_width	double	Can be used only for function_type = 4.
Rising phase [sec]	start_length	double	Can be used only for function_type = 4.
Decaying phase [sec]	end_length	double	Can be used only for function_type = 4.
Initial value [A]	initial_value	double	Can be used only for function_type = 2.
Time constant [sec]	time_constant	double	Can be used only for function_type = 2.
Offset (Unit example, [sec])	offset_x	double	
Offset [A]	offset_voltage	double	
Cyclic flag of point sequence	flag_cyclic	int	=0: Periodic
			=1: Not periodic

- **Magnetization**

In the Magnetization block, the settings for the magnetizing tool are specified.

Item name	Parameter name	Type	Description
Magnetization flag	execute_with_magnetization	int	=0: Do not magnetize =1: Magnetize =2: Run magnetization analysis (Designer 4.0) =3: Use magnetized magnet (Designer 4.0) =4: Run magnetic field analysis with magnetized magnet (Designer 4.0)
Input file before magnetizing	input_file	string	
Input file after magnetizing	output_file	string	
Magnetization during calculation	flg_analysis_with_magnetaization_gui	int	=0: Do not magnetize during calculation =1: Magnetize during calculation
Magnetization for the existing file	flg_exexute_existing_file_gui	int	=0: Do not magnetize in the existing file =1: Magnetize in the existing file
Background	flg_background_gui	int	=0: Do not run in background =1: Run in background
Status display	flg_show_status_gui	int	=0: Do not display the status =1: Display the status

- **MagnetizationDerive**

In the MagnetizationDerive block, the parameters for the magnetizing tool are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
PLOT file to be referenced	reference_plot_file_path	string	* absolute path
Data type	data_type	int	=1: Flux density =2: Magnetization =6: Magnetic field

Item name	Parameter name	Type	Description
Value to be used	flg_use_value	int	=0: Step specified
			=1: Maximum value within the specified range
Specified step/Start step	start_step	int	Specified step when flg_use_value= 0 Start step when flg_use_value= 1
End step	end_step	int	
Magnetization type	data_type	int	=1: Complete magnetization
			=3: Incomplete magnetization (isotropic)
			=4: Incomplete magnetization (anisotropic)
			=5: User definition
Point sequence type	flg_magnetization_table	int	=0: Magnetizing ratio
			=1: Magnetizing ratio and recoil relative permeability
User definition	user_id	int	Negative integer
Transformation table	flg_move_file	int	=1: Do not use
			=3: Use
Maximum coersive force [A/m]	max_coercive_force	double	

- **CoilInductance**

In CoilInductance, a coil inductance tool is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Current function ID	current_func_id	int	
Current value	current_value	double	
Saturation flag	flg_saturation	int	
Current value flag	flg_current	int	=0: Constant value
			=1: Offset value
Time-specified flag	flg_time	int	=0: Not specified.
			=1: Specified.
Start time	start_time	double	
End time	end_time	double	

- **SpeedDef**

In SpeedDef, the item when executing the cooperation with a speed is specified.

Item: None

- **Part_in_PartialInductance**

In Part_in_PartialInductance, the use of a magnetization program in a permanent magnet is specified.

Item name	Parameter name	Type	Description
Conductor ID	id	int	
Name	tag	type	
Material ID	material_id	int	

- **BusbarInductanceParametric**

In BusbarInductanceParametric, the use of a brush component is specified.

Item name	Parameter name	Type	Description
Name	tag	type	details
Minimum value of frequency	freq_min	double	
Maximum value of frequency	freq_max	double	
Number of fre-quency divisions	freq_division	int	
Frequency division method	freq_division_type	int	=0: Equal division =1: Logarithmic division
Upper-limit usage flag of part distance	flg_part_distance	int	=0: Not used. =1: Used.
Upper limit of part distance [m]	part_distance_max	int	
Lower-limit usage flag of current value	flg_current	int	=0: Not used. =1: Used.
Lower limit of cur-rent value [%]	current_min	int	

- **Ironloss**

In Ironloss, the calculation of an iron loss is specified.

Item name	Parameter name	Type	Description
Stress reference type	reference_stress_type	int	=0: Stress not referenced. =1: Referenced PLOT file of structural analysis =2: Set for each material.
PLOT file of referenced structural analysis	reference_stress_plot_file_path	string	
Absolute path of output PLOT file	output_file_path	string	
Absolute path of input PLOT file	reference_plot_file_path	string	
Setting of basic frequency	flg_basic_frequency_setting_type	int	=1: Sets basic frequency based on the number of poles and rotations. =2: Sets basic frequency to the specified value.
Number of Poles	poles	int	
Revolution speed [rpm]	revolution_speed	double	
Basic frequency [Hz]	basic_frequency	double	
Type of hysteresis loss calculation	hysteresis_loss_calc_type	int	
Type of eddy current loss calculation	joule_loss_calc_type	int	
Reference start step	start_reference_step	int	
Reference end step	end_reference_step	int	
Output flag of out-frequency ratio	flg_multiple_frequency	int	=0: Outputs results of both basic frequency and frequency ratio together (default setting). =1: Outputs only the result of basic frequency.
Output flag of the sum of loss in each step	flg_addition_steps	int	=0: Not calculate the sum of loss for multiple steps specified in ST and FQ. =1: Calculates the sum of loss for multiple steps specified in ST and FQ.

Item name	Parameter name	Type	Description
Result expanded by one cycle	cyclicity	int	
Motion	flg_motion	int	=0: Not allowed
			=1: Allowed
Absolute path of input PLOT file	solver_file_path	string	
Result conversion	flg_use_conversion	int	=0: Do not convert to full model
			=1: Follow the result conversion flag for analysis control
User subroutine iron_str.cpp	flg_iron_str	int	=0: Do not use
			=1: Use
Name of user sub-routine dll	usrsub_name	string	

- **Insulation**

In Insulation, the items related to insulation conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	

- **GapElement**

In the GapElement block, the gap element conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Title	title	string	
Gap thickness [m]	thickness	double	

- **Element_in_Subcycling**

In Element in subcycling, the relationships between the component in the subcycling condition and each condition are set.

<table>
<tr><th>Item name</th><th>Parameter name</th><th>Type</th><th>Description</th></tr>
<tr><td>Condition ID</td><td>id</td><td>int</td><td></td></tr>
<tr><td>Component name</td><td>name</td><td>string</td><td></td></tr>
<tr><td rowspan="4">Component type</td><td rowspan="4">element_type</td><td rowspan="4">int</td><td>=1: R_FEM (resistance)</td></tr>
<tr><td>=2: L_FEM (inductance)</td></tr>
<tr><td>=3: V_FEM (induced voltage)</td></tr>
<tr><td>=4: SHAFT</td></tr>
<tr><td rowspan="3">Condition type</td><td rowspan="3">keyid</td><td rowspan="3">int</td><td>=1: FEM coil condition</td></tr>
<tr><td>=2: Motion condition</td></tr>
<tr><td>=3: Electromagnetic force and torque condition</td></tr>
</table>

- **Parameters_in_Subcycling**

In Parameters in Subcycling, the relationships between the magnetic field analysis component in the subcycling condition and each condition are set.

<table>
<tr><th>Item name</th><th>Parameter name</th><th>Type</th><th>Description</th></tr>
<tr><td>Time unit of magnetic field analysis [sec]</td><td>dt</td><td>double</td><td>Flag to skip magnetic field analysis if the change is minimal</td></tr>
<tr><td rowspan="2">Flag for skipping magnetic field analysis if the charge is minimal</td><td rowspan="2">inductance_skip</td><td rowspan="2">int</td><td>=0: Not skip magnetic field analysis if the change is minimal</td></tr>
<tr><td>=1: Skips magnetic field analysis if the change is minimal</td></tr>
<tr><td>Rated current [A]</td><td>rated_current</td><td>double</td><td></td></tr>
<tr><td>Current threshold [%]</td><td>current_threshold</td><td>double</td><td></td></tr>
<tr><td rowspan="2">Motion type</td><td rowspan="2">motion_type</td><td rowspan="2">int</td><td>=1: Rotational motion</td></tr>
<tr><td>=2: Translational motion</td></tr>
<tr><td>Displacement threshold</td><td>disp_threshold</td><td>double</td><td>When motion_type=1, unit is [deg].
When motion_type=2, unit is [m]</td></tr>
</table>

- **ExternalCircuitCouple**

In ExternalCircuitCouple, the item of cooperation conditions with an external circuit simulator is specified.

Item name	Parameter name	Type	Description
Element name	external_name	string	
Flag for using subcycling condition	flg_extermal	int	=0: Not use subcycling condition
			=1: Uses subcycling condition

- **Psim_in_ExternalCircuitCouple**

In Psim_in_ExternalCircuitCouple, the detailed data on the cooperation conditions with an external circuit simulator is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Input/output flag	inout	int	=1: In
			=2: Out
Conditional key ID	keyid	int	=10005: Motion conditions
			=10007: Calculation conditions of electromagnetic force and torque
			=12: Supply voltage components
			=13: Supply current components
			=19: Potential probe components
			=20: Current probe components
Terminal name	name	string	
Order number	order	int	
Component	type	int	=0: Circuit
			=1: x
			=2: y
			=3: z
			=4: theta
			=5: torque

- **ThermalSourceCalculation**

In the ThermalSourceCalculation block, the heat source is specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	condition_title	string	
Method	object_type	int	=0: Resistance component =1: FEM coil condition
Resistance component ID	resistor_id	int	
FEM coil condition ID	fem_coil_id	int	

- **FrozenPermeability**

Specifies an item for a frozen permeability condition in the FrozenPermeability block (JMAG-Designer only).

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	title	string	
Plot file for magnetic analysis result for reference	plot_file	string	* Specify absolute path
Setting type for FP method	flg_setting_type_fp	int	=1: Use permeability (μ) =2: Use B and Material curve =3: Use differential μ
Use average permeability flg_use_average_permeability	flg_use_average_permeability	int	Can be selected when the magnetic field analysis plot file that is referred is a transient response analysis =0: Do not use the average value =1: Use the average value
Average start step	start_step	int	Use when flg_use_average_permeability=1
Average end step	end_step	int	Use when flg_use_average_permeability=1

- **PartialModel**

In the PartialModel block, the partial model conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	title	string	
Rotational periodicity	flg_cyclic_map	int	=0: Do not use
			=1: Use
Mirror symmetry	flg_mirror_map	int	=0: Do not use
			=1: Use
Translational periodicity	flg_translation_map	int	=0: Do not use
			=1: Use
Rotational period angle	angle	double	Use when flg_cycle_map=1
Distance [m]	distance	double	Use when flg_translation_map=1
Number of copies	copy_number	double	Use when flg_translation_map=1
A point on rotation axis	origin	double	
Direction vector	direction_vector	double	Use when flg_translation_map=1 * specified for each component
Rotational periodic boundary	flg_rotation_periodic_boundary	int	=0: Do not use
			=1: Use
Translational periodic boundary	flg_translation_periodic_boundary	int	=0: Do not use
			=1: Use

- **CutPlaneAnalysis**

In CutPlaneAnalysis, the detailed data on the cooperation conditions with an external circuit simulator is specified.

Item name	Parameter name	Type	Description
Type	type	int	=0: Treats a cut plane as 2D (axisymmetric model not included). =1: Treats a cut plane as axisymmetric.
Origin [m]	origin	point	type=0: A given point on the cut plane. type=1: A given point on the axis.
Normal vector on cut plane	normal_vector	point	Normal vector on the cut plane
Axis vector	axis_vector	point	type=0: No vector type=1: Axis vector

B-5. Setting Materials (material_data)

The items on the materials of magnetic field analysis are specified.

In the description below, there is an item in which a "number" is described in [Parameter name] as given in an example. The meaning of this number varies depending on the type of materials as described below.

- For isotropic magnetic material or isotropic electromagnetic steel sheet: Always 1
- For anisotropic electromagnetic steel sheet: 1 = Easy-axis direction, 2 = Hard-axis direction

Example:

Item name	Parameter name	Type	Description
Relative permeability	permeability_Number	complex	Can be used for flg_magnetic_property1 = 1.

- **Material**

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Material type	material_category	int	=1: Air
			=2: Coil
			=3: Non-magnetic material
			=4: Isotropic magnetic material
			=5: Magnet
			=6: Isotropic electromagnetic steel sheet
			=7: Anisotropic electromagnetic steel sheet
			=8: Anisotropic magnetic material
Gap element-specified flag	flg_gap_element	int	=0: Not gap element
			=1: Gap element
Thickness of gap element [m]	gap_size	double	(Valid only for element type ETYP = 7.)
Material result output flag	flg_io_material	int	=0: Not output.
			=1: Output.
Magnetizing properties to be referenced (Magnetizing properties of first-axis direction)	flg_magnetic_property1	int	=1: Linear materials (Magnetizing properties)
			=2: Nonlinear materials (H-B table)
			=3: Nonlinear materials (B-M table)
			=4: Nonlinear materials (B-r table)
			=5: Nonlinear materials (T-r table)
			=7: Material database
			=10: Non-magnetic material (Relative permeability = 1.0)
			=16: User subroutine (stress dependent)
			=22: Nonlinear materials (temperature-dependent H-B table)
			= Negative integer: A user subroutine (magusr.f) is used.
			* The anisotropy below is valid only for IFLGM = 1, 2, and 7 (UserSteel only). Always 0 for except described

Item name	Parameter name	Type	Description
Magnetizing properties of second-axis direction	flg_magnetic_property2	int	=0: Not used. (Same as isotropy and magnetizing properties to be referenced.)
			=1: Linear materials (Magnetizing properties)
			=2: Nonlinear materials (H-B table)
			=7: Material database (User Steel)
Magnetizing properties of third-axis direction	flg_magnetic_property3	int	=0: Not used. (Same as isotropy and magnetizing properties to be referenced.)
			=1: Linear materials (Magnetizing properties)
			=2: Nonlinear materials (H-B table)
			=7: Material database (User Steel)
2D magnetizing property type	flg_2dimensional_magnetization	int	=0: 2D magnetizing properties (Interpolated type)
			=1: 2D magnetizing properties (Simplified type)
Lamination type	flg_use_lamination_factor	int	=0: Not use a lamination factor.
			=1: Uses the lamination factor of a laminated steel sheet. (The second axis is the lamination direction.)
			=2: Uses the lamination factor of a laminated steel sheet. (The third axis is the lamination direction.)
First-axis electrical properties	flg_electric_property1	int	=0: Electrical conductivity is constant.
			=2: Electrical conductivity is a temperature function.
			=3: Electrical properties are a super-conductor (bean model).
			=4: Electrical properties are a super-conductor (I-V model).
			=5: Electrical properties are a super-conductor (user-defined type in which usrsc.f is used).
			=10: Isolator (Electrical conductivity = 0.0)
			= Negative integer: A user subroutine (conusr.f) is used.

Item name	Parameter name	Type	Description
Second-axis electrical properties	flg_electric_property2	int	=0: Electrical conductivity is constant. =2: Electrical conductivity is a temperature function.
Third-axis electrical properties	flg_electric_property3	int	=0: Electrical conductivity is constant. =2: Electrical conductivity is a temperature function.
Relative permeability (real part)	permeability_number	double	Can be used for flg_magnetic_property1 = 1.
Relative permeability (imaginary part)	permeability_imaginary_number	double	Can be used for flg_magnetic_property1 = 1.
Point sequence table number of magnetizing properties	mag_table_number_gui	int	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)
Point sequence table name of magnetizing properties	mag_table_number_name_gui	string	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)

Item name	Parameter name	Type	Description
Manufacturer flag	flg_material_supplier_number	int	=1: Hitachi (former SSMC)
			=2: User steel sheet
			=3: User magnet
			=4: Shin-Etsu Chemical
			=5: Hitachi Metals
			=6: Nippon Steel
			=7: TDK
			=8: JMAG data (Linear magnetizing properties)
			=9: JMAG data (Ferrite system)
			=10: JMAG data (Permalloy system)
			=11: Hoganas AB
			=13: Daido Electronics
			=14: JFE Steel
			=15: Hitachi (both 1 and 5)
			=16: Daido Steel
			=17: Sumitomo Metal
			=18: MITSUBISHI STEEL
			=19: MITSUBISHI STEEL (Permendur)
			=20: Hitachi (Ferrite)
			=21: TDK (Ferrite)
			=22: China Steel
			=23: Tokyo Ferrite
			=24: Hitachi Metals (magnet)
			=25: JSOL (steel sheet)
			=26: JSOL (magnet)
			=27: JFE Ferrite
			=28: VAC
Material type	flg_supplier_material_type_number	int	=1: Electromagnetic steel sheet (hb and hba files)
			=2: Magnet (hb and hbt files)
			=3: Magnet <any temperature> (hbp file)
			=4: Magnet <anti-magnetic field demagnetization only> (hbp file)
			=5: Magnet <anti-magnetic field and thermal demagnetization> (hbp file)

Item name	Parameter name	Type	Description
BH curve file name	bh_curve_file_name_number	string	(Relative path below database directory) (Extension.hbt when temperature dependency is provided.) (Extension.hba when anisotropy is provided.) (Extension.hbp when a demagnetization curve parameter is provided.) (Up to 80 characters)
Electrical conductivity [1/ohm*m]	conductivity_number	double	Can be used for flg_electric_property_gui = 0.
Temperature dependent database-specified temperature	temperature_gui_number	double	The temperature specified using temperature dependent database is output.
Relative permittivity	permittivity_number	double	Can be used for flg_electric_property_gui = 0. Default is 1. A value of more than 1 is limited.
Point sequence table number of temperature dependent electrical conductivity	elec_table_number_gui	int	
Point sequence table name of temperature dependent electrical conductivity	elec_table_number_name_gui	string	
Initial electrical conductivity [1/ohm*m]	initial_conductivity	double	Can be used for flg_electric_property_gui = 3, 4, and 5.
Electrical conductivity [1/ohm*m]	conductivity_max	double	Can be used for flg_electric_property_gui = 3, 4, and 5.
n value of I-V model	n_value	double	Can be used for flg_electric_property_gui = 4.
Critical current density [A/m^2]	critical_current_density	double	Can be used for flg_electric_property_gui = 3 and 4.

Item name	Parameter name	Type	Description
Magnetic flux density dependent flag of critical current density	flag_jcb	int	Can be used for flg_electric_property_gui = 3 and 4.
			=0: Critical current density is linear.
			=1: Critical current density depends on the magnetic flux density (specify direction)
			=2: Critical current density depends on the magnetic flux density (absolute value).
Anisotropic flag of Superconductor properties	flag_aniso_conductivity	int	=0: Electrical conductivity is isotropic.
			= Negative integer: A user subroutine (conusr) is used.
Point sequence table number of magnetic flux density dependent critical current density	jcb_table_gui	int	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)
Point sequence table name of magnetic flux density dependent critical current density	jcb_table_name_gui	string	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)
Unit flag of electrical properties	flg_conductivity_unit	int	=0: Electrical conductivity [1/(ohm·m)]
			=1: Electric resistivity [ohm·m]
			Only electrical conductivity in JMAG-Studio 8.2 or former
Flag in consideration of eddy current	flg_use_conductivity	int	=0: Not generated.
			=1: Generated.
Flag to use material database value in electrical conductivity	flg_use_db_conductivity	int	=0: Not use
			=1: Use
Insulation flag	Insulation	int	=0: Not insulate in the material surface
			=1: Insulate in the material surface
Temperature type	flg_temperature_function_type	int	=0: Point sequence
			=3: Constant value
			(Always set to IFLGT = 3 when a hbt file is used.)
Temperature (constant value)	temperature	double	

Item name	Parameter name	Type	Description
Temperature point sequence table number	temperature_table_gui	int	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)
Temperature point sequence table name	temperature_table_name_gui	string	JMAG-Studio 8.12101 is added. (Exclusively used for Studio.)
Magnet-related flag	flg_exist_magnet	int	=0: No magnet conditions
			>0: ID of magnet conditions
			(Memo) Compatible with the skipped number.
			(Memo) Compatible with the skipped number.
Magnetization program usage flag	flg_use_magnetization	int	=0: Not use.
			=1: Use.
Isotropy/Anisotropy of a magnet flag	flg_use_anisotropic_magnet	int	=0: Isotropy
			=1: Anisotropy
Coercive force [A/m]	coercive_force	double	* Valid when the H-B curve is not a demagnetization curve (the second quadrant is not contained). Also valid when an H-B curve is not used. This is handled as coercive force during magnetization of 100% when a magnetization program is used.
Anisotropic conditional number	flg_anisotropy	int	=0: The anisotropy of a steel sheet is not considered or a global coordinate system is used.
			>0: Anisotropic ID of steel sheet
SIBC usage flag	flg_sibc	int	=0: SIBC conditions are not used.
			=1: SIBC conditions are used.
			Can be used only in frequency response analysis.
			Can be used only when electrical conductivity is isotropic and constant.
Lamination factor	lamination_factor	double	0.0 or more and 1.0 or less. Default is 1.0.
Saturation magnetization correction coefficient (%)	correct_magnetization_factor	double	0.0 or more, default value 100.0
Residual magnetic flux density correction coefficient (%)	correct_br_factor	double	0.0 or more, default value 100.0

Item name	Parameter name	Type	Description
Coercive force correction coefficient (%)	correct_coercive force_factor	double	0.0 or more, default value 100.0
Local coordinate system number	local_coordinate_id	int	
Flag to use database of mass density	flg_use_db_density_gui	int	=0: Not use =1: Use
Initial stress for each material [MPa]	stress	double	
Material coordinate system number	ds_local_coordinate_id	int	
Mass density [kg/m3]	mass_density	double	
Stress dependent user subroutine	usrstr_property_id	int	Material ID for using usrstr

■ Iron loss calculation material data

• IronlossMaterial

In IronlossMaterial, the materials used in the calculation of an iron loss are specified.

Item name	Parameter name	Type	Description
Calculation target	flg_use_ironloss	int	=0: Not calculated
			=1: Calculated
Loss-specified type	loss_type	int	=1: A coefficient and multiplier are specified.
			=2: Database
			=3: Hysteresis loss and eddy current loss files
Calculation type	calc_type	int	=1: Calculated according to the size.
			=2: Calculated for each component.
Coordinate system ID	coordinate_id	int	
Type of coordinate system	coordinate_type	int	=0: Not used.
			=1: Rectangular coordinate system
			=2: Cylindrical coordinate system
x-direction usage flag	use_x_component	int	=0: Not used.
			=1: Used.
y-direction usage flag	use_y_component	int	=0: Not used.
			=1: Used.
z-direction usage flag	use_z_component	int	=0: Not used.
			=1: Used.
x-direction coefficient and multiplier-specified conditional number	coefficients_x	int	For loss_type = 1
y-direction coefficient and multiplier-specified conditional number	coefficients_y	int	For loss_type = 1
z-direction coefficient and multiplier-specified conditional number	coefficients_z	int	For loss_type = 1
x-direction material database	database_x	string	For loss_type = 2

Item name	Parameter name	Type	Description
y-direction material database	database_y	string	For loss_type = 2
z-direction material database	database_z	string	For loss_type = 2
hysteresis loss file (each component)	hysteresis_loss_path_number	string	For loss_type = 3 The numbers to be entered for "number" are 1= X component 2= Y component 3= Z component
eddy current loss file (each component)	joule_loss_path_number	string	For loss_type = 3 The numbers to be entered for "number" are 1= X component 2= Y component 3= Z component
Principal stress (III)[MPa]	principal_stress_3	double	For loss_type = 3
α type	flg_alpha	int	=0: constant =1: specified using coefficient/multiplier file
α (when specifying the value)	alpha_value	double	
α (when using a loss file)	alpha_path_number	string	
β type	flg_beta	int	=0: constant =1: specified using coefficient/multiplier file
β (when specifying the value)	beta_value	double	
β (when using a loss file)	beta_path_number	string	
γ type	flg_gamma	int	=0: constant =1: specified using coefficient/multiplier file
γ (when specifying the value)	gamma_value	double	
γ (when using a loss file)	gamma_path_number	string	

Item name	Parameter name	Type	Description
δ type	flg_delta	int	=0: constant =1: specified using coefficient/multiplier file
δ (when specifying the value)	delta_value	double	
δ (when using a loss file)	delta_path_number	string	
Ke type	flg_Ke	int	=0: constant =1: specified using coefficient/multiplier file
Ke (when specifying the value)	Ke_value	double	
Ke (when using a loss file)	Ke_path_number	string	
Kh type	flg_Kh	int	=0: constant =1: specified using coefficient/multiplier file
Kh (when specifying the value)	Kh_value	double	
Kh (when using a loss file)	Kh_path_number	string	
User subroutine iron_str.cpp (X direction)	flg_iron_str_x	int	=0: Do not use =1: Use
User subroutine material ID (X direction)	user_defined_property_id_x	int	=0: Do not use =1: Use
User subroutine iron_str.cpp (Y direction)	flg_iron_str_y	int	=0: Do not use =1: Use
User subroutine material ID (Y direction)	user_defined_property_id_y	int	=0: Do not use =1: Use
User subroutine iron_str.cpp (Z direction)	flg_iron_str_z	int	=0: Do not use =1: Use
User subroutine material ID (Z direction)	user_defined_property_id_z	int	=0: Do not use =1: Use

■ Magnetization analysis material data

Item name	Parameter name	Type	Description
Reference magnetizing properties	flg_demagnetization_property1	int	=1: Linear material (magnetizing properties)
			=2: Nonlinear material (BH table)
			=7: Material database
Relative permeability used for magnetized magnet	demagnetization_permeability_number	complex	Used for linear magnetizing properties The numbers to be entered for "number" are: 1=X component 2=Y component 3=Z component
Manufacturer flag	flg_demagnetization_supplier_number	int	=1: Hitachi (former SSMC)
			=2: User steel sheet
			=3: User magnet
			=4: Shin-Etsu Chemical
			=5: Hitachi Metals
			=6: Nippon Steel
			=7: TDK
			=8: JMAG data (Linear magnetizing properties)
			=9: JMAG data (Ferrite system)
			=10: JMAG data (Permalloy system)
			=11: Hoganas AB
			=13: Daido Electronics
			=14: JFE Steel
			=15: Hitachi (both 1 and 5)
			=16: Daido Steel
			=17: Sumitomo Metal
			=18: MITSUBISHI STEEL
			=19: MITSUBISHI STEEL (Permendur)
			=20: Hitachi (Ferrite)
			=21: TDK (Ferrite)
			=22: China Steel
			=23: Tokyo Ferrite
			=24: Hitachi Metals (magnet)
			=25: JSOL (steel sheet)
			=26: JSOL (magnet)
			=27: JFE Ferrite
			=28: VAC

Item name	Parameter name	Type	Description
Material type	flg_supplier_demagnetization_type_number	int	The numbers to be entered for "number " are: 1=X component 2=Y component 3=Z component =1: Electromagnetic steel sheet (hb and hba files) =2: Magnet (hb and hbt files) =3: Magnet <any temperature> (hbp file) =4: Magnet <anti-magnetic field demagnetization only> (hbp file) =5: Magnet <anti-magnetic field and thermal demagnetization> (hbp file)
Magnetization type	magnetization_type	int	=1: Complete magnetization =3: Incomplete magnetization (isotropic) =4: Incomplete magnetization (anisotropic) =5: User definition
Data type to be referenced	reference_data_type	int	=1: Flux density =2: Magnetization =6: Magnetic field
Value to be used	flg_use_value	int	=0: Specified step =1: Maximum value within the specified range
Specified step/Start step	start_step	int	Specified step when flg_use_value=0 Start step when flg_use_value=1
End step	end_step	int	Used when flg_use_value=1
PLOT file to be referenced	reference_plot_file_path	string	Path of referenced file
Data type to be referenced (magnetization)	reference_orientation_type	int	=1: Flux density =2: Magnetization =6: Magnetic field
Value to be used (magnetization)	flg_use_value_orientation	int	=0: Specified step =1: Maximum value within the specified range
Specified step/Start step (magnetization)	start_step_orientation	int	Specified step when flg_use_value_orientation=0 Start step when flg_use_value_orientation=1

Item name	Parameter name	Type	Description
End step (magnetization)	end_step_orientation	int	Used when flg_use_value_orientation=1
Point sequence type	flg_magnetization_table	int	=0: Magnetizing ratio
			=1: Magnetizing ratio and recoil relative permeability
User definition	user_id	int	Negative integer
JCF file of magnetized magnet to be referenced	reference_jcf_file_path	string	

Appendix C. PLOT File Format (Magnetic Field Analysis)

C-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

71-75	ID_SLV	Solver ID
		=0: 3D static analysis (ST (3D))
		=1: 3D frequency response analysis (FQ (3D))
		=2: 3D transient response analysis (TR (3D))
		=3: 2D transient response analysis (DP)
		=4: Axis symmetric transient response analysis (DP (AX))
		=5: Electric field analysis (EL)
		=6: Current distribution analysis (EL)
		=7: Charge distribution analysis (CH)
		=8: Thermal analysis (HT)
		=9: Electromagnetic wave frequency response analysis (WV)
		=10: Electromagnetic wave transient response analysis (TD)
		=11: 2D frequency response analysis (FQ (2D))
		=12: 2D axis symmetric frequency response analysis (FQ (AX))
		=13: 2D static analysis (ST (2D))
		=14: 2D axis symmetric static analysis (ST (AX))
76-80	IVER	Version number (81)

Card 3

1-20	UNITOT	Unit for the result display

21-40	UNITIN	Unit for the geometry data
41-80	UNITNM	Unit label

C-2. Controlling PLOT File

Card 1

1-10	MAXPLT	Division size of plot file (MByte)

C-3. Output Conversion of Model

Card 1

1-10	IMODEL	Output flag for full model conversion =0: Not convert =1: Convert
11-20	ICOIL	Flag for specifying height of FEM coil =0: Height of FEM coil is the same as the thickness of model =1: Height of FEM coil differs from the thickness of model

Card 2

1-20	DTHICK	Thickness of model [m] Note: Available only for 2D analysis. Note: Not available for 3D analysis and axi-ally-symmetric analysis.
21-40	VLNG	Height of FEM coil [m] Note: Available only for 2D analysis.
41-60	DIVMD	Division multiplier (Information on division created by dividers other than rotational periodic boundary.) Example: For one-to-nth division model, the output value is multiplied by n.
61-80	DDIVCY	Status information on division created by rotational periodic boundary

C-4. Parameter Conversion of Circuit

Card 1

1-10	NCMDL	Conversion flag =0: Partial model (Not convert to calculate) =1: Full model (Convert by using periodic boundary condition and division multiplier to calculate)
11-20	NN2	Connection status at the time of conversion =0: Series (Multiplier is applied to all calculation results of voltage.) =1: Parallel (Multiplier is applied to all calculation results of current passing through external circuit.)

Card 2

1-20	DIVCI	Division multiplier (Information on division created by dividers other than rotational periodic boundary.)

C-5. Coordinate Data

1-10	NUMNP	Number of nodes

1-10	ID	Order ID
11-20	ID	Node ID
21-40	X	X-coordinate
41-60	Y	Y-coordinate
61-80	Z	Z-coordinate

C-6. Element Data

Card 1

1-8	NUMEL	Total elements
9-20	MAXMAT	Number of material properties

Card 2

1-8	M	Element ID
9-11	IEL(M)	Number of nodes
12-14	MTYP(M)	Material ID
15-16	ETYP(M)	Element type
		=1: Solid hexahedron element (first coordinate)
		=2: Solid hexahedron element (second coordinate)
		=3: Solid tetrahedron element (first coordinate)
		=4: Solid tetrahedron element (second coordinate)
		=5: Solid pentahedron element (first coordinate)
		=6: Solid pentahedron element (second coordinate)
		=7: Shell quadrilateral element (first coordinate)
		=8: Shell quadrilateral element (second coordinate)
		=9: Beam element (first coordinate)
		=10: Beam element (second coordinate)
		=11: Shell triangle element (first coordinate)
		=12: Shell triangle element (second coordinate)
		=13: Pyramid element (first coordinate)
		=14: Pyramid element (second coordinate)
17-24	NOD(1,IEL)	Node ID (1)
25-32	NOD(2,IEL)	Node ID (2)
33-40	NOD(3,IEL)	Node ID (3)

41-48	NOD(4,IEL)	Node ID (4)
49-56	NOD(5,IEL)	Node ID (5)
57-64	NOD(6,IEL)	Node ID (6)
65-72	NOD(7,IEL)	Node ID (7)
73-80	NOD(8,IEL)	Node ID (8)

C-7. Analysis Results

C-7-1. Control Data (ST, TR, DP)

1-80	CONTROL_DATA	Header (2)
1-10	ISTEP	Analysis step number
11-30	TIME	Time

C-7-2. Control Data (FQ)

1-80	CONTROL_DATA	Header (3)
1-10	ISTEP	Analysis step number
11-30	FREQ	Frequency

C-7-3. Displacement (Node Data)

1-80	DISPLACEMENT	Header (10001)
1-10	MAXING	Number of nodes with displacement
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of MAXING

1-10	I	Order ID
11-20	ING(I)	Node ID
21-40	DSPX(I)	X-component of displacement
41-60	DSPY(I)	Y-component of displacement
61-80	DSPY(I)	Z-component of displacement

C-7-4. Vector Potential (Node Data) (DP)

1-80	VECTOR_POTENTIAL	Header (11005)
1-10	MAXING	Total nodes
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of MAXING

1-10	I	Order ID
11-20	ING(I)	Node ID
21-40	A(I)	X-component of vector potential
41-60	A(I)	Y-component of vector potential
61-80	A(I)	Z-component of vector potential

C-7-5. Vector Potential (Node Data) (DP)

1-80	VECTOR_POTENTIAL	Header (14504)

1-10	MAXING	Total nodes
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of MAXING

1-10	I	Order ID
11-20	ING(I)	Node ID
21-40	A(I)	X-component of vector potential (real part)
41-60	A(I)	Y-component of vector potential (real part)
61-80	A(I)	Z-component of vector potential (real part)
81-100	A(I)	X-component of vector potential (imaginary part)
101-120	A(I)	Y-component of vector potential (imaginary part)
121-140	A(I)	Z-component of vector potential (imaginary part)

C-7-6. Magnetic Flux Density (Element Data) (ST, TR, DP)

1-80 MAGNETIC_FLUX_DENSITYHeader (16001)

1-10	NUM	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	BX(N)	X-component of magnetic flux density
41-60	BY(N)	Y-component of magnetic flux density
61-80	BZ(N)	Z-component of magnetic flux density

C-7-7. Magnetic Flux Density (Element Data) (FQ)

1-80 MAGNETIC_FLUX_DENSITYHeader (19501)

1-10	NUM	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	BX(N)	X-component of magnetic flux density (real part)
41-60	BY(N)	Y-component of magnetic flux density (real part)
61-80	BZ(N)	Z-component of magnetic flux density (real part)
81-100	BX_I(N)	X-component of magnetic flux density (imaginary part)
101-120	BY_I(N)	Y-component of magnetic flux density (imaginary part)
121-140	BZ_I(N)	Z-component of magnetic flux density (imaginary part)

C-7-8. Magnetization (Element Data) (ST, TR, DP)

1-80 MAGNETIZATION_VECTORHeader (16505)

1-10	NMAGV	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	VMAGX(N)	X-component of magnetization
41-60	VMAGY(N)	Y-component of magnetization
61-80	VMAGZ(N)	Z-component of magnetization

C-7-9. Remanent Magnetic Flux Density (Element Data) (ST, TR, DP)

1-80 RESIDUAL_MAGNETIC_FLUX_DENSITYHeader (16514)

1-10	NUMBR2	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	BRVEC(N)	Remanent magnetic flux density

C-7-10. Magnetization (Element Data) (FQ)

1-80 MAGNETIZATION_VECTORHeader (19504)

1-10	NMAGV	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	VMAGX(N)	X-component of magnetization (real part)
41-60	VMAGY(N)	Y-component of magnetization (real part)
61-80	VMAGZ(N)	Z-component of magnetization (real part)
81-100	VMAGX_I(N)	X-component of magnetization (imaginary part)
101-120	VMAGY_I(N)	Y-component of magnetization (imaginary part)
121-140	VMAGZ_I(N)	Z-component of magnetization (imaginary part)

C-7-11. Magnetic Field (Element Data) (ST, TR, DP)

1-80 MAGNETIC_FIELD_VECTORHeader (16509)

1-10	NMAGV	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	HX(N)	X-component of magnetic field
41-60	HY(N)	Y-component of magnetic field
61-80	HZ(N)	Z-component of magnetic field

C-7-12. Magnetic Field (Element Data) (FQ)

1-80	MAGNETIC_FIELD _VECTOR Header (19508)	

1-10	NMAGV	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	HX(N)	X-component of magnetic field (real part)
41-60	HY(N)	Y-component of magnetic field (real part)
61-80	HZ(N)	Z-component of magnetic field (real part)
81-100	HX_I(N)	X-component of magnetic field (imaginary part)
101-120	HY_I(N)	Y-component of magnetic field (imaginary part)
121-140	HZ_I(N)	Z-component of magnetic field (imaginary part)

C-7-13. Electric Field (Element Data) (FQ)

1-80	ELECTRIC_FIELD	Header (19505)

1-10	NUMEL2	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	EVEC(N)	X-component of electric field (real part)
41-60	EVEC(N)	Y-component of electric field (real part)
61-80	EVEC(N)	Z-component of electric field (real part)
81-100	EVEC(N)	X-component of electric field (imaginary part)
101-120	EVEC(N)	Y-component of electric field (imaginary part)
121-140	EVEC(N)	Z-component of electric field (imaginary part)

C-7-14. Current Density (Element Data) (ST, TR, DP)

1-80	EDDY_CURRENT_DENSITY	Header (16503)

1-10	NUMED	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	EDX(N)	X-component of current density
41-60	EDY(N)	Y-component of current density
61-80	EDZ(N)	Z-component of current density

C-7-15. Current Density (Element Data) (FQ)

1-80	EDDY_CURRENT_DENSITYHeader (19502)	

1-10	NUMED	Number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	EDX(N)	X-component of current density (real part)
41-60	EDY(N)	Y-component of current density (real part)
61-80	EDZ(N)	Z-component of current density (real part)
81-100	EDX_I(N)	X-component of current density (imaginary part)
101-120	EDY_I(N)	Y-component of current density (imaginary part)
121-140	EDZ_I(N)	Z-component of current density (imaginary part)

C-7-16. Surface Current Density (Shell Element Data) (FQ)

1-80	EDDY_CURRENT_DENSITY_SHELLHeader (19510)	

1-10	NUMED3	Number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	EDDYF(N)	X-component of surface current density (real part)
41-60	EDDYF(N)	Y-component of surface current density (real part)
61-80	EDDYF(N)	Z-component of surface current density (real part)
81-100	EDDYF(N)	X-component of surface current density (imaginary part)
101-120	EDDYF(N)	Y-component of surface current density (imaginary part)
121-140	EDDYF(N)	Z-component of surface current density (imaginary part)

C-7-17. Line Current (Beam Element Data) (ST, TR, DP)

1-80	CURRENT	Header (16507)

1-10	NBEAMC	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	CURB(1,N)	X-component of line current
41-60	CURB(2,N)	Y-component of line current
61-80	CURB(3,N)	Z-component of line current

C-7-18. Line Current (Beam Element Data) (FQ)

1-80	CURRENT	Header (19507)
1-10	NBEAMC	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	CURB(1,N)	X-component of line current (real part)
41-60	CURB(2,N)	Y-component of line current (real part)
61-80	CURB(3,N)	Z-component of line current (real part)
81-100	CURB(1,N)	X-component of line current (imaginary part)
101-120	CURB(2,N)	Y-component of line current (imaginary part)
121-140	CURB(3,N)	Z-component of line current (imaginary part)

C-7-19. Hysteresis Loss (Element Data)

1-80	HYSS_LOSS	Header (6505)
1-10	NUMED	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	LOD(N)	Hysteresis loss density

C-7-20. Joule Loss Density and Joule Loss (Element Data)

1-80	CURRENT_LOSS	Header (7501)

1-10	NUMED	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order number
11-20	N	Element ID
21-40	LOD(N)	Joule loss density
41-60	LO(N)	Joule loss

C-7-21. Surface Joule Loss Density (Element Data)

1-80	CURRENT_LOSS_SHELLHeader (16515)	

1-10	NUMLS3	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order number
11-20	N	Element ID
21-40	ELOSSF(N)	Surface joule loss density

C-7-22. Nodal Force (Node Data)

1-80	NODAL_FORCE	Header (11501)

1-10	NUMF	Total number of electromagnetic force nodes
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of electromagnetic force nodes.

1-10	I	Order number
11-20	ISUF	Node ID
21-40	SXD(ISUF)	X-component of nodal force
41-60	SYD(ISUF)	Y-component of nodal force
61-80	SZD(ISUF)	Z-component of nodal force

C-7-23. Surface Force Density (Element Data)

1-80	SURFACE_FORCE	Header (16504)

1-10	NUMSUF	Total number of surface force elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of elements.

1-10	I	Order number
11-20	ISUF	Surface force element ID
21-40	LXD(ISUF)	X-component of surface force density
41-60	LYD(ISUF)	Y-component of surface force density
61-80	LZD(ISUF)	Z-component of surface force density

C-7-24. Lorentz Force Density (Element Data)

1-80	LORENTZ_FORCE	Header (16502)

1-10	NUMSUF	Total number of Lorentz force elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of elements.

1-10	I	Order number
11-20	ISUF	Lorentz force element ID
21-40	LXD(ISUF)	X-component of Lorentz force density
41-60	LYD(ISUF)	Y-component of Lorentz force density
61-80	LZD(ISUF)	Z-component of Lorentz force density

C-7-25. Analysis Error (Element Data)

1-80	ERROR	Header (6503)

1-10	NUMERR	Total number of analysis error output elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of elements.

1-10	I	Order ID
11-20	IERR	Element ID
21-40	ERRH(IERR)	Error

C-7-26. Principal Stress (Element Data)

1-80	PRINCIPAL_STRESS	Header(16513)

1-10	NUMED	Total number of evaluation elements
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the total number of evaluation elements.

1-10	I	Order ID
11-20	N	Element ID
21-40	STRES (N)	Principal Stress(1)[Mpa]
41-60	STRES (N)	Principal Stress(2)[Mpa]
61-80	STRES (N)	Principal Stress(3)[Mpa]

C-7-27. Joule Loss (Step Data)

1-80	JOULE_LOSS_PER_GROUPHeader (501)	

1-10	NUMAT	Number of material properties
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of material properties.

1-10	MATID	Material ID
11-30	TLOSS(IGL)	Loss
31-50	Unused	

C-7-28. Hysteresis Loss (Step Data)

1-80	HYSTERESIS_LOSS	Header (551)

1-10	NUMHL	Total number of number of hysteresis loss calculation groups (Number of material properties + 1)
11-20	FLAG	Convert (1) Not Convert (0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of groups

1-10	MATID	Material ID
11-30	HLOSS(IGL)	Hysteresis loss

(The content of the item at the NUMHL is the sum of hysteresis losses listed above.)

C-7-29. Electromagnetic Force and Torque (Step Data)

1-80	FORCE&TORQUE_PER_GROUPHeader (601)	
1-10	NUMGT	Total number of electromagnetic force calculation groups
11-20	FLAG	Convert (1) Not Convert (0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of groups

1-10	IGT	Group ID
11-30	FX(IGT)	X-component of electromagnetic force
31-50	FY(IGT)	Y-component of electromagnetic force
51-70	FZ(IGT)	Z-component of electromagnetic force
71-90	T (IGT)	Torque

C-7-30. Lorentz Force (Step Data)

1-80	LORENTZ_FORCE_PER_GROUPHeader (701)	
1-10	NUMAT	Number of material properties
11-20	FLAG	Convert (1) Not Convert (0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of material properties.

1-10	MATID	Material ID
11-30	FLTZM(1)	X-component of lorentz force
31-50	FLTZM(2)	Y-component of lorentz force
51-70	FLTZM(3)	Z-component of lorentz force

C-7-31. Magnetic Flux (Step Data) (ST, TR, DP)

1-80	FLUX_GROUP	Header (901)
1-10	NGRPX	Total number of magnetic flux calculation groups
11-20	FLAG	Convert (1) Not Convert (0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of groups

1-10	IGT	Group ID
11-30	FLUX(IGT)	Magnetic flux [Wb]

C-7-32. Magnetic Flux (Step Data) (FQ)

1-80	FLUX_GROUP_R	Header (18701)

1-10	NGRPX	Total number of magnetic flux calculation groups
11-20	FLAG	Convert (1) Not Convert (0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of groups.

1-10	IGT	Group ID
11-30	FLUX(IGT)	Magnetic flux (real part) [Wb]

1-80	FLUX_GROUP_I	Header (18801)
1-10	NGRPX	Total number of magnetic flux calculation groups
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of groups.

1-10	IGT	Group ID
11-30	FLUX_I(IGT)	Magnetic flux (imaginary part) [Wb]

C-7-33. Electric Potential (Step Data) (DP, TR)

1-80	TERMINAL_VOLTAGE	Header (18001)
1-10	NUMVP	Total number of terminals
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of terminals.

1-10	NP	Terminal number
11-30	AVEC(NP)	Electric potential [V]

C-7-34. Electric Potential (Step Data) (FQ)

1-80	TERMINAL_VOLTAGE_RHeader (18001)	
1-10	NUMVP	Total number of terminals
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of terminals.

1-10	NP	Terminal number
11-30	AVEC(NP)	Electric potential (real part) [V]
1-80	TERMINAL_VOLTAGE_IHeader (18051)	
1-10	NUMVP	Total number of terminals
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of terminals.

1-10	NP	Terminal number
11-30A	VEC_I(NP)	Electric potential (imaginary part) [V]

C-7-35. Current (Step Data) (TR, DP)

1-80	LINE_CURRENT	Header (18101)
1-10	NUMVL	Total number of line elements
11-20	FLAG	Convert(1)Not Convert(0)

21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of line elements.

1-10	IGT	Line element ID
11-30	CRTV(IGT)	Current [A]

C-7-36. Current (Step Data) (FQ)

1-80	LINE_CURRENT_R	Header (18101)
1-10	NUMVL	Total number of line elements
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of line elements.

1-10	IGT	Line element ID
11-30	CRTV(IGT)	Current (real part) [A]
1-80	LINE_CURRENT_I	Header (18151)
1-10	NUMVL	Total number of line elements
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of line elements.

1-10	IGT	Line element ID
11-30	CRTV_I(IGT)	Current (imaginary part) [A]

C-7-37. Stored Energy (Step Data)

1-80	STORED_ENERGY	Header (801)
1-10	NUMAT+1	Number of material properties + 1
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of material properties + 1.

1-10	MATID	Material ID
11-30	ENRGY	Energy

(The content of the item at the (NUMAT + 1) is the sum of energies listed above [J].)

C-7-38. ON/OFF Information of Circuit Component (Step Data)

1-80	LINE_ONOFF	Header (20001)
1-10	NUMVL	Total number of line elements
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of line elements.

1-10	IGT	Line element ID
11-20	ISWCH(IGT)	Open/close status of circuit
		=1: ON
		=0: OFF
		=-1: Always ON

C-7-39. Magnetic Flux in Current Condition (Step Data)

1-80	FLUX_of_Current_ControlHeader (60001)	
1-10	NGRPS	Total number of current conditions
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of current conditions.

1-10	NP	Current condition number
11-30	FLUXC(NP)	Magnetic flux (real part) [Wb]
31-50	FLUXC(NP)	Magnetic flux (imaginary part) [Wb]

C-7-40. Magnetic Flux of FEM Coil (Step Data)

1-80	FLUX_of_FEM_Coil	Header (70001)

1-10	NGRPV	Total number of FEM coils
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of FEM coils.

1-10	NP	FEM coil number
11-30	FLUXV(NP)	Magnetic flux (real part) [Wb]
31-50	FLUXV(NP)	Magnetic flux (imaginary part) [Wb]

C-7-41. Current Value in Current Condition (Step Data)

1-80	CURRENT_of_Current_ControlHeader (80001)	

1-10	NGRPS	Total number of current conditions
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of current conditions.

1-10	NP	Current condition number
11-30	CURRC(NP)	Current (real part) [A]
31-50	CURRC(NP)	Current (imaginary part) [A]

C-7-42. Current Value of FEM Coil (Step Data)

1-80	CURRENT_of_FEM_CoilHeader (90001)	
1-10	NGRPV	Total number of FEM coils
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of FEM coils.

1-10	NP	FEM coil number
11-30	CURRV(NP)	Current (real part) [A]
31-50	CURRC(NP)	Current (imaginary part) [A]

C-7-43. Total Distance (Step Data)

1-80	DISP_of_Motion	Header (110001)
1-10	MGRP	Number of motion conditions
11-20	FLAG	Convert(1)Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of motion conditions.

1-10	IGT	Group ID
11-30	FX(IGT)	X-axis direction transfer [m]
31-50	FY(IGT)	Y-axis direction transfer [m]
51-70	FZ(IGT)	Z-axis direction transfer [m]
71-90	T (IGT)	Rotation angle [deg]

C-7-44. Contact Angle of Brush and Commutator (Step Data)

1-80	Brush_Contact_Angle	Header (20002)
1-10	NUM	Combination of brush component and commutator component
11-20	FLAG	0
21-40	CONV	0.0

* Repeat the following sequence up to the number of combination of brush component and commutator component

1-10	ITERM1	Terminal ID of brush component
11-20	ITERM2	Terminal ID of commutator component
21-40	ZANG(ITERM1,ITERM2)	Contact angle

C-7-45. Heat Source (Step Data)

1-80	THERMAL_SOURCE	Header (150013)

1-10	NUM	Total number of Heat Source conditions
11-20	FLAG	Convert(1) Not Convert(0)
21-40	CONV	Conversion multiplier (double)

* Repeat the following sequence up to the number of Heat Source conditions.

1-10	NG	Heat Source condition ID
11-30	CLSLC(NG)	Heat source [W]

C-7-46. End of Step (Step Data)

1-80	End_of_Step	Header (999999)

1-10	N	Always 1
11-20	FLAG	0
21-40	CONV	0.0

1-10	ISTEP	Step number

Appendix D. JCF File Format (Thermal Analysis)

This chapter describes various parameters that can be edited using a JCF file.

D-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

▶▶ Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:

-Target (Element ID, etc.)

-Type of item to be applied (Element face or nodal point, etc.)

-Contents of point sequence data used under conditions or material characteristics

D-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	common	Controls parameters related to the entire analysis.(P. 150)
condition_data	Control	Controls parameters for analysis control (study properties).(P. 151)
	Step	Controls parameters for step control.(P. 152)
	TemperatureBoundary	Controls parameters for equivalent temperature boundary condition.(P. 153)
	HeatFlux	Controls parameters for heat flux boundary condition.(P. 153)
	HeatTransfer	Controls parameters for heat transfer boundary condition.(P. 153)
	HeatRadiation	Control parameters for radiation heat transfer boundary condition.(P. 154)
	PeriodicBoundary	Controls parameters for periodic boundary condition.(P. 154)
	InitialTemperature	Controls parameters for initial temperature condition.(P. 154)
	HeatGeneration	Controls parameters for heat source condition.(P. 155)
	HeatMotion	Controls parameters for motion condition.(P. 156)
	HeatFlowCalculation	Controls parameters for heat flow condition.(P. 157)
	ContactResistance	Controls parameters for thermal contact resistance.(P. 157)
	HeatCircuitTerminal	Controls parameters for terminal of thermal circuit.(P. 157)
	HeatCircuitElement	Controls parameters for component of thermal circuit.(P. 158)
	HeatCircuitElementType	Controls component type for thermal circuit.(P. 158)
	AverageTemperatureCalc	Controls parameter for average temperature calculation condition.(P. 159)
	PartialModel	Controls parameters for partial model condition.(P. 160)

Block name		Description
material_data	MATERIAL	Controls parameters for material.(P. 161)

D-3. Basic Information of Analysis (control_parameters)

- **common**

In a common module, the item common to all analyses that are executed in JMAG is specified.

Item name	Parameter name	Type	Description
Analysis name	title	string	
Version No. of JMAG	version	int	
Solver ID	Solver_id	int	=8: Thermal analysis (HT)
Unit label	unit_label	string	
Shape unit of data	unit_input	double	
Confirmation unit of result	unit_output	double	
Restart flag	restart	int	=0: Normal run
			=1: Restart
Split size of result file [Mbyte]	max_plot_size	int	
PLOT file output mode	Plot_mode	int	=0: ASCII PLOT file
			=1: Binary PLOT file

D-4. Setting Conditions (condition_data)

- **Control**

In Control, the items of analytic control conditions are specified.

Item name	Parameter name	Type	Description
Analysis type	analysis_type	int	=0: Steady state analysis =1: Transient state analysis
Parameters for ICCG			
ICCG acceleration coefficient	iccg_accel	double	
ICCG convergence tolerance	iccg_tolerance	double	
Maximum number of ICCG iterations	iccg_max_iteration	int	
Parameters for nonlinear calculation			
Iterative tolerance of nonlinear calculation	max_tolerance	double	
Maximum number of nonlinear calculation iterations	max_iteration	int	
Parameters for coupled analysis			
Coupled analysis	coupling_type	int	=0: Usual =1: Two-way coupled analysis (with Magnetic field analysis/electromagnetic frequency response analysis) =2: Two-way coupled analysis (Current distribution analysis)
Parameters for restart			
Restart type	restart_type	int	=0: Normal run =1: Execution using restart file
Parameters for output control			
Output flag of temperature	flg_io_temperature	int	=0: Output for each node. =1: Not output.
Output flag of heat flux	flg_io_heat_flux	int	=0: Output for each element. =1: Not output.

Item name	Parameter name	Type	Description
Output flag of heat source density	flg_io_heat_generation_density	int	=0: Output for each element.
			=1: Not output.
Parameters for user subroutine			
User subroutine Dll	usrsub_name	string	
Usage flag of subroutine “usrstp”	flg_usrstp	int	=0: Disables the usrstp.f option.
			=1: Enables the usrstp.f option
Usage flag of subroutine “flgph”	flg_flgph	int	=0: Disables the flgph.f option.
			=1: Enables the flgph.f option
Usage flag of subroutine “phase1”	flg_phase1	int	=0: Disables the phase1.f option.
			=1: Enables the phase1.f option
Usage flag of subroutine “phase2”	flg_phase2	int	=0: Disables the phase2.f option.
			=1: Enables the phase2.f option
Usage flag of subroutine “quser”	flg_quser	int	=0: Disables the quser.f option.
			=1: Enables the quser.f option
Output interval type	output_timing_mode	int	=0: Output all steps
			=1: Output from specified step to last step
			=2: Use output interval table
First output step	output_timing_start_step	int	For output_timing_mode = 1

- **Step**

In Step, the items for step conditions are specified.

Item name	Parameter name	Type	Description
Type	step_type	int	=1: Regular interval
			=2: Point sequence
Initial value [sec]	start_time	double	* Can be used only for step_type = 1.
End point value [sec]	end_time	double	* Can be used only for step_type = 1.
Number of divisions	num_divisions	int	* Can be used only for step_type = 1.
Number of analysis steps	num_analysis_step	int	

- **TemperatureBoundary**

In TemperatureBoundary, the items for temperature boundary are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Temperature[Celsius]	temperature	double	
Type	temperature_type	int	=0:Set fixed temperature
			=1:Set constant temperature
			=2:Use in the circuit

- **HeatFlux**

In HeatFlux, the items for heat flux boundary are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Heat flux [W/m^2]	heat_flux_value	double	

- **HeatTransfer**

In HeatTransfer, the items for heat transfer boundary are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Type	heat_transfer_type	int	=0: Heat transfer coefficient is specified by point sequence
			=1: Heat transfer coefficient is constant
			=-1:Uses user subroutine
Flag for using in the circuit	flg_use_equivalent_circut	int	=0: Do not use in the circuit
			=1: Use in the circuit
Heat transfer coefficient [W/m^2*Celsius]	heat_transfer_coefficient	double	* Can be used only for heat_transfer_type=1.
Reference temperature [Celsius]	reference_temperature	double	

- **HeatRadiation**

In HeatRadiation, the items for heat radiation boundary are specified.

Item name	Parameter name	Type	Description
GroupID	id	int	
Type	heat_radiation_type	int	=0: Heat radiation transfer coefficient is specified by point sequence =1: Heat radiation transfer coefficient is constant =-1:Uses user subroutine
Reference temperature [Celsius]	reference_temperature	double	
Radiant parameter	heat_radiation_coefficient	double	* Can be used only for heat_radiation_type=1.

- **PeriodicBoundary**

In PeriodicBoundary, the items for periodic boundary are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Type	periodic_type	int	=+1: Rotation periodicity =+2: Translational periodicity <0: Anti-periodic boundary =-1: Rotation periodicity =-2: Translational periodicity
A point on rotation axis	origin	double	* Specified for each component.
Direction of rotation axis	axis_vector	double	* Specified for each component.
Periodic angle or distance	angle	double	Periodic angle for rotational periodicity [deg] Periodic distance for translational periodicity [m]

- **InitialTemperature**

In InitialTemperature, the items for initial temperature are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	

<table>
<tr><th>Item name</th><th>Parameter name</th><th>Type</th><th>Description</th></tr>
<tr><td>Initial temperature [Celsius]</td><td>initial_temperature</td><td>double</td><td></td></tr>
<tr><td rowspan="2">Setting method</td><td rowspan="2">initial_temperature_type</td><td rowspan="2">int</td><td>=0: Initial temperature is constant</td></tr>
<tr><td>=1: htemp file loading</td></tr>
</table>

- **HeatGeneration**

In HeatGeneration, the items for heat source are specified.

<table>
<tr><th>Item name</th><th>Parameter name</th><th>Type</th><th>Description</th></tr>
<tr><td>GroupID</td><td>id</td><td>int</td><td></td></tr>
<tr><td rowspan="5">Type</td><td rowspan="5">heat_generation_type</td><td rowspan="5">int</td><td>=0: Heat source density is specified by point sequence</td></tr>
<tr><td>=1: Total heat source is specified by point sequence</td></tr>
<tr><td>=2: Heat source density (coupled analysis)</td></tr>
<tr><td>=3: Heat source density is constant</td></tr>
<tr><td>=4: Total heat source is constant</td></tr>
<tr><td rowspan="2">Coupling type</td><td rowspan="2">generation_coupling_type</td><td rowspan="2">int</td><td>=0: One-way</td></tr>
<tr><td>=1: Two-way</td></tr>
<tr><td rowspan="2">Heat source</td><td rowspan="2">thermal_source_type</td><td rowspan="2">int</td><td>=0: Distribution</td></tr>
<tr><td>=1: Total loss</td></tr>
<tr><td>Heat source condition ID</td><td>themal_source_calculation_id</td><td>int</td><td></td></tr>
<tr><td>Referenced loss file</td><td>reference_loss_file</td><td>string</td><td></td></tr>
<tr><td>Referenced JCF file</td><td>reference_jcf_file</td><td>string</td><td></td></tr>
<tr><td rowspan="2">Mapping flag</td><td rowspan="2">flg_use_mapping</td><td rowspan="2">int</td><td>=0: Enables mapping</td></tr>
<tr><td>=1: Disables mapping</td></tr>
<tr><td rowspan="2">Flag for averaging Joule loss</td><td rowspan="2">flg_use_avloss</td><td rowspan="2">int</td><td>=0: Averages Joule loss</td></tr>
<tr><td>=1: Not average Joule loss</td></tr>
<tr><td rowspan="2">Method for averaging Joule loss</td><td rowspan="2">avloss_value_type</td><td rowspan="2">int</td><td>=0: Specifies step</td></tr>
<tr><td>=1: Specifies time</td></tr>
<tr><td>Start step for averaging Joule loss</td><td>avloss_start_step</td><td>int</td><td></td></tr>
<tr><td>End step for averaging Joule loss</td><td>avloss_end_step</td><td>int</td><td></td></tr>
</table>

Item name	Parameter name	Type	Description
Starting time specified for averaging Joule loss	avloss_start_time	double	
Termination time specified for averaging Joule loss	avloss_end_time	double	
Rotation average flag	flg_rotation_average	int	=0: Not average the rotation
			=1:Averages the rotation
z min. value [m]	map_zmin	double	
z max. value [m]	map_zmax	double	
Cut plane position [m]	map_section_position	double	* For 2D model
Cut plane position [deg]	map_section_angle	double	* For axisymmetric model
Heat source density [W/m^3] Total heat source [W]	heat_generation	double	* Heat source density when heat_generation_type=3 * Total heat source when heat_generation_type=4

- **HeatMotion**

The HeatMotion block specifies each setting for the motion condition.

Item name	Parameter name	Type	Description
Group ID	id	int	
A point on rotation axis	origin	double	* Specified for each component.
Direction of rotation axis	axis_vector	double	* Specified for each component.
Automatic time step	time_step_type	int	=0: Automatic
Motion flag	flg_motion_type	int	=0: Rotation motion
			=1: Translation motion
Displacement flag	flg_displacement_type	int	=0: Without node displaced
			=1: With node displaced
Method for specifying	flg_velocity_type	int	=0: Constant
			=1: Point sequence
Flag of rotation speed unit	flg_rotational_velocity_unit	int	=0: rps
			=1: rpm

- **HeatFlowCalculation**

In HeatFlowCalculation, ID of the heat flux calculation is specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Direction	flg_direction	int	=1: The outflow direction is positive.
			=-1: The inflow direction is positive.

- **ContactResistance**

In ContactResistance, the items for contact thermal resistance are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Type	contact_thermal_resistance_type	int	=0: Constant
			=1: Temperature table
			=2: Time table
Thermal resistance[Celsius/w]	contact_thermal_resistance	double	Available when contact_thermal_resistance_type=0

- **HeatCircuit**

In HeatCircuit, the IDs of components and terminals used on the equivalent circuit are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	

- **HeatCircuitTerminal**

In HeatCircuitTerminal, the items for the terminal on the heat equivalent circuit are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Initial temperature [Celsius]	initial_temperature	double	

- **HeatCircuitElement**

In HeatCircuitElement, the items for the component on the heat equivalent circuit are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Referenced component type ID	type_id	double	Referenced element-type id

- **HeatCircuitElementType**

In HeatCircuitElementType, items for the component type on the heat equivalent circuit are specified.

Item name	Parameter name	Type	Description
Group ID	id	int	
Component type	type	int	=1: Thermal resistance
			=2: Heat capacitor
			=3: Heat source
			=4: Heat transfer
			=5: Fixed temperature
			=6: FEM fixed temperature condition reference
			=7: FEM heat transfer condition reference
Thermal resistance type	thermal_resistance_type	int	When type=1
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency
Thermal resistance [Celsius/W]	thermal_resistance	double	When thermal_resistance_type=1
Heat capacity type	heat_capacity_type	int	When type=2
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency
Heat capacity [J/Celsius]	heat_capacity	double	When heat_capacity_type=1
Heat source type	heat_generation_type	int	When type=3
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency

Item name	Parameter name	Type	Description
Heat source [W]	heat_generation	double	When heat_generation_type=1
Heat transfer coefficient type	heat_transfer_coefficient_type	int	When type=4
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency
Heat transfer coefficient [W/Celsius]	heat_transfer_coefficient	double	When heat_transfer_coefficient=1
Reference temperature type	reference_temperature_type	double	When type=4
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency
Reference temperature [Celsius]	reference_temperature	double	When reference_temperature=1
Fixed temperature type	temperature_type	int	When type=5
			=0: Constant
			=1: Temperature dependency
			=2: Time dependency
Temperature (fixed) [Celsius]	temperature	double	When temperature_type=1/ when type=4
Reference condition ID	reference_condition_id	int	When reference condition ID type=6 or 7

- **AverageTemperatureCalc**

In AverageTemperatureCalc block, the average temperature calculation conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	condition_title	string	

- **PartialModel**

In PartialModel block, the partial model conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Condition name	title	string	
Rotational periodicity flag	flg_cyclic_map	int	=0: Not use =1: Use
Mirror symmetry flag	flg_mirror_map	int	=0: Not use =1: Use
Translational periodicity flag	flg_translation_map	int	=0: Not use =1: Use
Rotational period angle	angle	double	Use when flg_cycle_map=1
Distance [m]	distance	double	Use when flg_translation_map=1
Number of copies	copy_number	double	Use when flg_translation_map=1
A point on rotation axis	origin	double	
Direction vector	direction_vector	double	Use when flg_translation_map=1 *specifies for each component
Use rotational periodic boundary	flg_rotation_periodic_boundary	int	=0: Not use =1: Use
Use translational periodic boundary	flg_translation_periodic_boundary	int	=0: Not use =1: Use

D-5. Setting Materials (material_data)

- **MATERIAL**

The materials for the thermal analysis are specified.

Item name	Parameter name	Type	Description
Material ID	material_id	int	* Positive number
Thermal conductivity type	thermal_conductivity_property_type	int	=1: Linear =2: Nonlinear =-1: User subroutine ucond
Specific heat type	specific_heat_property_type	int	=1: Linear =2: Nonlinear =-1:User subroutine uspeci
Material result output flag	flg_io_material	int	=0: Not output. =1: Output.
Gap element-specified flag	flg_gap_element	int	=0: Not gap element =1: Gap element
Endotherm flag	flg_endothermic	int	=0: Ignores parameters of endotherm =1: Includes endotherm
Exclude the material from analysis	flg_exclusive	int	=0: Use the material in analysis =1: Not use the material in analysis
Density [kg/m^3]	density	double	
Density type	density_property_type	int	=1: Constant =2: Table =-1: User subroutine udnsty
Thermal conductivity [W/m•Celsius]	thermal_conductivity	double	
Specificheat [J/kg•Celsius]	specific_heat	double	
Endotherm coefficient [W/m^3•Celsius]	endothermic_coefficient	double	
Equilibrium body temperature [Celsius]	equilibrium_temperature	double	

Appendix E. PLOT File Format (Thermal Analysis)

E-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

1-5	Unused	
6-10	Unused	
11-15	Unused	
16-20	ITYPE	Coupled with thermal analysis
21-25	Unused	
26-30	Unused	
31-35	Unused	
36-40	Unused	
41-45	Unused	
46-50	Unused	
51-55	Unused	
56-60	Unused	
61-65	Unused	
66-70	Unused	
71-75	ID_SLV	Solver ID =0: 3D static analysis (ST (3D)) =1: 3D frequency response analysis (FQ (3D)) =2: 3D transient response analysis (TR (3D)) =3: 2D magnetic field analysis (DP (2D)) =4: Axis symmetric analysis (DP (AX)) =5: Electric field analysis (EL) =6: Current distribution analysis (EL) =7: Charge distribution analysis (CH) =8: Thermal analysis (HT)

		=9: Electromagnetic wave Frequency response analysis (WV)
		=10: Electromagnetic wave transient response analysis (TD)
75-80	IVER	Version number (= 81)

Card 3

1-5	ITRAN	Analysis type
6-10	NSTEP	Number of analysis steps
11-15	Unused	
16-20	NEWTON	Nonlinear iteration number
21-30	EPSITE	Nonlinear iterative convergence tolerance
31-35	Unused	
36-40	Unused	
41-45	Unused	
46-50	Unused	
51-55	Unused	
56-65	THETA	Time increment parameter for transient analysis
66-75	Unused	
76-80	Unused	

Card 4

1-20	UNITOT	Unit of result verification
21-40	UNITIN	Unit of shape data
41-80	UNITNM	Unit label

E-2. Control Output Items

Card 1

1-10	N_CNT2	Number of lines included in the control card 2

Card 2

1-10	ACCEL	Accel parameter for ICCG
11-20	EPSPCG	Tolerance for ICCG
21-30	MAXPCG	Max iteration for ICCG

Card 3

1-20	PCGMAX	Unused
21-30	MICGRS	Unused

Card 4

Set the flag to 1 for output, and to 0 for disabling output

1-5	IO_T	Temperature (node data) output flag
6-10	IO_FLX	Heat flux (element data) output flag
11-15	IO_HGN	Heat source density (element data) output flag

E-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	Number of lines

Card 2

1-10	MG_ON	Mesh generation execution flag
11-20	IBC_XY	Boundary condition flag for XY-plane
21-30	IBC_YZ	Boundary condition flag for YZ-plane
31-40	IBC_ZX	Boundary condition flag for ZX-plane

E-4. Step Interval Control

Card 1

1-10	NSTPTP	Unused
11-20	NSTPFG	Unused

Card 2

1-10	NSTBL	Unused
11-20	TBLID	Unused

E-5. Control Output Interval

Card 1

1-10	N_OUT	Number of output interval control data of analysis results

Card 2

1-10	N	Order number
11-20	N_END(N)	Output interval control end step
21-30	N_STP(N)	Output interval up to time N

E-6. Coordinate Data

1-10	NUMNP	Number of nodes

1-10	ID	Order number
11-20	ID	Node ID
21-40	X	X-coordinate
41-60	Y	Y-coordinate
61-80	Z	Z-coordinate

E-7. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	MAXNOD	Maximum number of nodes within element
11-15	NINT	Integral point

Card 2

1-8	M	Element ID
9-11	IEL(M)	Total nodes
12-14	MTYP(M)	Material ID
15-16	ETYP(M)	Element type
		=1: Solid hexahedron element (first coordinate)
		=2: Solid hexahedron element (second coordinate)
		=3: Solid tetrahedron element (first coordinate)
		=4: Solid tetrahedron element (second coordinate)
		=5: Solid pentahedron element (first coordinate)
		=6: Solid pentahedron element (second coordinate)
		=7: Shell element (first coordinate)
		=8: Shell element (second coordinate)
		=9: Beam element (first coordinate)
		=10: Beam element (second coordinate)
17-24	NOD(1,IEL)	Node ID (1)
25-32	NOD (2,IEL)	Node ID (2)
33-40	NOD(3,IEL)	Node ID (3)
41-48	NOD(4,IEL)	Node ID (4)
49-56	NOD(5,IEL)	Node ID (5)
57-64	NOD(6,IEL)	Node ID (6)
65-72	NOD(7,IEL)	Node ID (7)
73-80	NOD (8,IEL)	Node ID (8)

E-8. Analysis Results

E-8-1. Control Data

Card 1

1-80	CONTROL_DATA	Header(2)

Card 2

1-10	ISTEP	Analysis step number
11-30	TIME	Time

E-8-2. Displacement (Node Data)

(If there is translation)

Card 1

1-80	DISPLACEMENT	Header (10001)

Card 2

1-10	NUMD	Number of nodes with displacement

Card 3 (Repeat NUMD times hereinafter)

1-10	I	Order ID
11-20	NP(I)	Node ID
21-40	DSPX(I)	X-component of displacement
41-60	DSPY(I)	Y-component of displacement
61-80	DSPY(I)	Z-component of displacement

E-8-3. Temperature Distribution (Node Data)

Output, if ID_SLV = 8 and IO_T =1

Card 1

1-80	NODAL_TEMP	Header(2501)

Card 2

1-10	NO_NP	Number of nodes which temperature distribution is to be output

Card 3 (* Repeat the NO_NP)

1-10	I	Order number
11-20	N	Node ID
21-40	T (N)	Temperature of the Nth node

E-8-4. Heat Flux Vector (Element Data)

Output, if ID_SLV = 4 and IO_FLX =1

Card 1

1-80	HEAT_FLUX	Header (16506)

Card 2

1-10	NO_EL	Number of elements which heat flux vector is to be output

Card 3 (* Repeat the NO_EL)

1-10	I	Order number
11-20	N	Element ID
21-40	E(1,N)	X-component of heat-flux vector in the Nth element
41-60	E(2,N)	Y-component of heat-flux vector in the Nth element
61-80	E(3,N)	Z-component of heat-flux vector in the Nth element

E-8-5. Heat Flow (Step Data)

Card 1

1-80	HEAT_FLOW	Header (150001)

Card 2

1-10	NGFLW	Number of groups which heat flow is to be output

Card 3 (* Repeat the NO_EL)

1-10	I	Order number
1-30	F(I)	Heat flow of the Ith group

E-8-6. Heat Source Density

Output, if ID_SLV = 8 and IO_HGN =1

Card 1

1-80	HEAT_GENERATION_DENSITYHeader (150002)	

Card 2

1-10	NEHGN	Number of elements which heat source density to be output

Card 3 (* Repeat the NEHGN)

1-10	I	Order ID
11-20	N	Element ID
21-40	HGN(N)	Heat source density in the Nth element

E-8-7. Amount of Heat Source

Card 1

1-80	TOTAL_HEAT_GENERATIONHeader (150003)	

Card 2

1-10	NGHGN	Number of groups which amount of heat source is to be output

Card 3 (* Repeat the NEHGN)

1-10	I	Order ID
11-30	TTHGN(I)	Amount of heat source in the Ith element

E-8-8. Average Temperature (Step Data)

Card 1

1-80	AVERAGE_TEMPERATUREHeader (150004)	

Card 2

1-10	NGTMP	Number of groups which average temperature is to be output

Card 3 (* Repeat the NGTMP)

1-10	I	Order ID
11-30	AVTMP(I)	Average temperature of the Ith group

E-8-9. Terminal Temperature (Step Data)

Card 1

1-80	TERMINAL_TEMPERATUREHeader (150005)	

Card 2

1-10	NTTMP	Number of terminals which terminal temperature is to be output

Card 3 (* Repeat the NTTMP)

1-10	I	Order ID
11-30	TRTMP(I)	Temperature of the Ith terminal

E-8-10. Total Displacement (Step Data)

1-80	*DISP_of_Motion	Header(110001)
1-10	NGRPM	Number of motion condition

* The following repeats the number of motion conditions

1-10	IGT	Group ID
11-30	FX(IGT)	Displacement of X direction [m]
31-50	FY(IGT)	Displacement of Y direction [m]
51-70	FZ(IGT)	Displacement of Z direction [m]
71-90	T(IGT)	Rotation angle [deg]

Appendix F. JCF File Format (Electric Field Analysis)

This chapter describes various parameters that can be edited using a JCF file.

F-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

▶▶ Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:
-Target (Element ID, etc.)
-Type of item to be applied (Element face or nodal point, etc.)
-Contents of point sequence data used under conditions or material characteristics

F-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	common	Controls parameters related to the entire analysis.(P. 175)
condition_data	Control	Controls parameters for analysis control (study properties).(P. 176)
	Step	Controls parameters for step control or frequency control.(P. 177)
	ElectricPotential	Controls parameters for electric potential boundary condition.(P. 178)
	ElectricField	Controls parameters for electric field boundary condition.(P. 178)
	CurrentDensity	Controls parameters for current density boundary condition.(P. 178)
	CyclicBoundary	Controls parameters for periodic boundary condition.(P. 179)
	ForceCalculation	Controls parameters for force condition.(P. 179)
	ElectricChargeCalculation	Controls parameters for surface charge distribution condition.(P. 179)
	CurrentCalculation	Controls parameters for current condition.(P. 180)
	ElectricChargeFace	Controls parameters for face charge condition.(P. 180)
	ElectricChargeVolume	Controls parameters for volume charge condition.(P. 180)
	TemperatureDistribution	Controls parameters for temperature distribution condition.
	Conductor	Controls parameters for conductor condition.(P. 181)
	Insulation	Controls parameters for insulation condition.(P. 181)
	InitialParticle	Controls parameters for initial particle density condition.(P. 181)
	TransitionMatrix	Controls parameters for transition coefficient matrix condition.(P. 181)
material_data	MATERIAL	Controls parameters for material.

F-3. Basic Information of Analysis (control_parameters)

- **common**

The settings that are related to all the analysis types in JMAG are specified.

Item name	Parameter name	Type	Description
Analysis name	title	string	
JMAG version number	version	int	
Solver ID	solver_id	int	=5: Electric field analysis (Static analysis) (EL)
			=6: Electric field analysis (Static analysis) (EL)
			=51: Electric field analysis (Frequency response analysis) (EL)
Unit label	unit_label	string	
Shape unit of data	unit_input	double	
Confirmation unit of result	unit_output	double	
Restart flag	restart	int	=0: Restart normally
			=1: Restart
ID of ilnked CAD data	cad_data_guid	string	
Bus for linked CAD data	cad_linkage_path	string	Full path
Type of linked CAD software	cad_name	string	=SolidWorks
			=CATIA V5 (JMAG-Designer only)
			=Pro/E (JMAG-Designer only)
			=NX (JMAG-Designer only)
Healing during linkage	flg_healing_for_cadlink	int	=0: Healing does not occur during linkage
			=1: Healing occurs during linkage
Partition size for PLOT file [MByte]	max_plot_size	int	
Export mode for PLOT file	plot_mode	int	=0: Ascii PLOT file
			=1: Binary PLOT file
Update for Study	study_checksum	string	(JMAG-Designer only)
Study Title	study_title	string	(JMAG-Designer only)
UUID for Study	study_uuid	string	(JMAG-Designer only)

F-4. Setting Conditions (condition_data)

• Control

The settings in the analysis control condition are set in the Control block.

Item name	Parameter name	Type	Description
Coupled analysis flag	coupling_type	int	=0: Usual =1: Two-way coupled analysis (with Thermal analysis) * Can be used when analysis type is analysis_type = 3
Restart flag	restart_type	int	=0: Restart normally =1: Run when restart file is used
Analysis Type	analysis_type	int	=0: Static analysis =1: Current Distribution Analysis =2: Charge distribution analysis *Available when JMAG-Studio is used =3: Frequency response analysis
Acceleration coefficient using the iterative linear solver	iccg_accel	double	
Convergence tolerance using the iterative linear solver	iccg_tolerance	double	
Maximum number of iterations using the iterative linear solver	iccg_max_iteration	int	
Nonlinear Iterative Convergence Tolerance	max_tolerance	double	
Nonlinear Iterations	max_iteration	int	
Output flag in electric potential	flg_io_electric_potential	int	=0: Output =1: Does not output
Output flag in charge volume	flg_io_electric_field	int	=0: Output =1: Does not output
Output flag for particle density	flg_io_particle_number_density	int	=0: Output =1: Does not output

Item name	Parameter name	Type	Description
Output flag for Nodal Charge	flg_io_charge_node	int	=0: Output
			=1: Does not output
Output flag in current	flg_io_current	int	=0: Output
			=1: Does not output
Output flag in surface charge	flg_io_charge_face	int	=0: Output
			=1: Does not output
Output flag in nodal force	flg_io_nodal_force	int	=0: Output
			=1: Does not output
Output flag in charge volume	flg_io_charge_volume	int	=0: Output
			=1: Does not output
Output flag for Joule loss	flg_io_juleloss	int	=0: Output
			=1: Does not output
Output flag for thermal electromotive force loss	flg_io_thermoloss	int	=0: Output
			=1: Does not output
Out put flag for total loss	flg_io_loss	int	=0: Output
			=1: Does not output

- **Step**

Specifies the step condition in the Step block.

Item name	Parameter name	Type	Description
Type	step_type	int	=0: Constant Interval
			=1: Regular intervals
			=2: Point sequence
Number of steps	num_analysis_step	int	
Width interval	increment	double	
Initial value	start_value	double	
End point [sec]	end_value	double	
Divisions	step_division	int	

- **ElectricPotential**

Specifies the electric potential boundary condition in the ElectricPotential block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Electric potential [V]	amplitude	double	
Phase [deg]	phase	double	Available when the frequency response analysis is used

- **ElectricField**

Specifies the electric field condition in ElectricField block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Electric field [V/m]	amplitude	double	
Phase [deg]	phase	double	Available when the frequency response analysis is used
Specify direction	flg_direction	int	=1: Outflow direction as the correct value =-1: Inflow direction as the correct value

- **CurrentDensity**

Specifies the current density boundary condition in CurrentDensity block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Current density [A/m2]	amplitude	double	
Phase [deg]	phase	double	Available when the frequency response analysis is used
Specify direction	flg_direction	int	=1: Outflow direction as the correct value =-1: Inflow direction as the correct value

- **CyclicBoundary**

Specifies the periodic boundary condition in CyclicBoundary block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Periodicity type	cyclic_type	int	=+1: Periodic boundary x Rotational =+2: Periodic boundary x Translational periodicity =+3: Axial reverse =-1: Antiperiodic boundary x Rotational =-2: Antiperiodic boundary x Translational periodicity
Point on axis	origin	point	Specify point.
Direction of rotation axis/translation direction	axis_vector	point	Specify component. Direction of rotation axis direction when cyclic_type=+1 or -1. Translation direction when cyclic_type=+2 or -2
Periodic angle or Periodic distance	angle	double	Periodic angle [deg] for rotational periodicity. Periodic distance [m] for translational periodicity

- **ForceCalculation**

Specifies the electromagnetic force condition in the ForceCalculation block.

Item name	Parameter name	Type	Description
Conditional number	id	int	

- **ElectricChargeCalculation**

Specifies the surface charge condition in the ElectricChargeCalculation block.

Item name	Parameter name	Type	Description
Conditional number	id	int	

- **CurrentCalculation**

Specifies the current condition in the CurrentCalculation block.

Item name	Parameter name	Type	Description
Conditional number	id	int	

- **ElectricChargeFace**

Specifies the surface charge condition in the ElectricChargeFace block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Charge density [C/m2]	amplitude	double	

- **ElectricChargeVolume**

Specifies the volume charge condition in the ElectricChargeVolume block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Charge density [C/m3]	amplitude	double	

- **TemperatureDistribution**

Specify the item for the temperature distribution condition in the TemperatureDistribution block.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Coupling type	coupling_type	int	=0: One-way coupled analysis =1: Two-way coupled analysis
Result file name of thermal analysis for referencing	reference_post_file	string	

- **Conductor**

Specifies the conductor condition in the Conductor block.

Item name	Parameter name	Type	Description
Conditional number	id	int	

- **Insulation**

Specifies the insulation condition in the Insulation block.

Item name	Parameter name	Type	Description
Conditional number	id	int	

- **InitialParticle**

Specifies the initial particle density conditions in InitialParticle block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Diffusion constant [m2/sec]	diffusion_constant	double	
Initial particle number density [1/m3]	initial_number	int	

- **TransitionMatrix**

Specifies the transition coefficient matrix condition in the TransitionMatrix block.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Transition coefficient matrix	matrix	int	

F-5. Specifying Materials (material_data)

- **MATERIAL**

Specifies materials for the Electric Field Analysis.

Item name	Parameter name	Type	Description
Material ID	material_id	int	The value does not need to be positive or sequential
Electric properties of the first axis	flg_electric_property1	int	=0: Electric conductivity is constant
			=2: Temperature of the electric conductivity is a function
			=11: Electric conductivity in the electric field is a function
			=12: Electric conductivity in the frequency is a function
			= negative integer: user subroutine Unit flag for electric properties of (cndusr.f)
Unit flag for electric properties	flg_conductivity_unit	int	=0: Electric conductivity [1/(ohm·m)]
			=1: Electric Resistivity [ohm·m]
Electric conductivity [1/(ohm·m)]	conductivity_number	double	Can be used when flg_electric_property_gui=0
Relative permittivity type flag	flg_permittivity_property	int	=0: Relative Permittivity is constant
			=1: Relative permittivity in the electric field is a function
			=2: Relative permittivity in the frequency is a function
Relative permittivity	permittivity_number	complex	Frequency response analysis Can be used when flg_electric_property_gui=0 The default is 1 and at least 1 for limited value
Result output flag for each material	flg_io_material	int	=0: Does not output
			=1: Output
Particle flight region	flg_movable_particle	int	=0: Does not output
			=1: Output

Appendix G. Solver Data File Format (Electric Field Analysis)

G-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

16-20	ITYPE	=0: Normal run
		=2: Coupled with Thermal Analysis
71-75	ID_SLV	Solver ID
		=0: 3D Static Analysis (ST (3D))
		=1: 3D Frequency Response Analysis (FQ (3D))
		=2: 3D Transient Response Analysis (TR (3D))
		=3: 2D Magnetic Field Analysis (DP (2D))
		=4: Axis Symmetric Analysis (DP (AX))
		=5: Electric Field Analysis (EL)
		=6: Current Distribution Analysis (EL)
		=7: Charge Distribution Analysis (CH)
		=51: Electric Field Analysis (frequency response) (EL)
		=8: Thermal Analysis (HT)
		=9: Electromagnetic Wave Frequency Response Analysis (WV)
		=10: Electromagnetic Wave Transient Response Analysis (TD)
76-80	IVER	Version number (= 84)

Card 3

1-5	ISELECT	Analysis type
		=0: Electric field analysis
		=1: Current distribution analysis
		=2: Charge distribution analysis

		=3: Electric field analysis (frequency response)
6-10	NSTEP	Number of analysis steps
16-20	NEWTON	Nonlinear iteration number
21-30	EPSITE	Nonlinear iterative convergence tolerance

G-2. Control Output Items

Card 1

1-10	N_CNT2	Number of lines in the control card 2

Card 2

1-10	ACCEL	Accel parameter for ICCG
11-20	EPSPCG	Tolerance for ICCG
21-30	MAXPCG	Max iteration for ICCG

Card 3

1-20	PCGMAX	Unused
21-30	MICGRS	Unused

Card 4

Set the flag to 1 for output, and to 0 for disabling output

1-5	IO_V	Electric potential (node data) output flag
6-10	IO_E	Electric field (element data) output flag
11-15	IO_P	Particle density (node data) output flag
16-20	IO_Q	Nodal density (node data) output flag
21-25	IO_J	Current (element data) output flag
26-30	IO_SFQ	Surface charge density (element data) output flag
31-35	IO_NF	Nodal force (node data) output flag
36-40	IO_INQ	Internal Charge (element data) output flag
41-45	IO_JL	Power consumptuon (element data) output flag
46-50	IO_TL	Thermal electromotive force loss (element data) output flag
51-55	IO_TTL	Total loss (element data) output flag

G-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	Number of lines

Card 2

1-10	MG_ON	Mesh generation execution flag (= 0: OFF, = 1: ON)
11-20	IBC_XY	Boundary condition flag for XY-plane (= 1: Natural, = 0: No condition, = 1: Symmetric)
21-30	IBC_YZ	Boundary condition flag for YZ-plane (= 1: Natural, = 0: No condition, = 1: Symmetric)
31-40	IBC_ZX	Boundary condition flag for ZX-plane (= 1: Natural, = 0: No condition, = 1: Symmetric)

Card 3

1-10	I_ADP	Adaptive flag (= 0: OFF, = 1: ON)
11-20	ITR	Max iteration for adaptive calculation

Card 4

1-20	ERR_B	Acceptable error range
21-40	(ERR_J)	Unused (0.0)

G-4. Step Control

Card 1

1-10	NSTPTP	Unused
11-20	NSTPFG	Unused

Card 2

1-10	NSTBL	Unused
11-20	TBLID	Unused

G-5. Control Output Interval

Card 1

1-10	N_OUT	Number of output interval control data for analysis result

Card 2

1-10	N	Order number
11-20	N_END (N)	Output interval control end step
21-30	N_STP (N)	Output interval up to the N_END (N) step Example: If N_STP (N) = 2, it is controlled to output once every two times. Note: If N_STP (N) = 0, output is disabled.

G-6. Coordinate Data

Card 1

1-10	NUMNP	Total nodes

Card 2

1-10	I	Order ID
11-20	N	Node ID
21-40	X (N)	X-coordinate [m]
41-60	Y (N)	Y-coordinate [m]
61-80	Z (N)	Z-coordinate [m]

G-7. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	MAXNOD	Maximum number of nodes within element
11-15	NINT	Integral points

Card 2

1-8	M	Element ID
9-11	IEL	Total nodes
12-14	MTYP	Material ID
15-16	ETYP	Element type =1: Solid hexahedron element (first coordinate) =2: Solid hexahedron element (second coordinate) =3: Solid tetrahedron element (first coordinate) =4: Solid tetrahedron element (second coordinate) =5: Solid pentahedron element (first coordinate) =6: Solid pentahedron element (second coordinate) =7: Shell element (first coordinate) =8: Shell element (second coordinate) =9: Beam element (first coordinate) =10: Beam element (second coordinate)
17-24	NOD (1)	Node ID
25-32	NOD (2)	Node ID
33-40	NOD (3)	Node ID
41-48	NOD (4)	Node ID
49-56	NOD (5)	Node ID
57-64	NOD (6)	Node ID
65-72	NOD (7)	Node ID
73-80	NOD (8)	Node ID

G-8. Material Property Data

Card 1

1-10	NUMAT	Number of material property types
11-20	MAXTP	Maximum number of thermal conductivity tables

Card 2

1-10	M	Material ID
11-20	IFLAG (M)	=1: Linear material
		=2: Nonlinear material (E-epsilon Table (electric field))
		=3: Nonlinear material (E-sigma Table (current distribution))
		=5:Nonlinear material (T- sigma Table (current distribution))
		=Negative integer:Use the user subroutine cndusr
		=-1:Use user subroutine
21-30	IAREA (M)	Flag for particle flight region discrimination
31-40	MTOUT (M)	=0: Not output
		=1: Output
41-50	IFLAGGP (M)	=0: Not gap element
		=1: Gap element

Card 3 (If IFLAG = 1)

1-20	EPERM_R (M)	Permeability (real part)
21-40	EPERM_I (M)	Permeability (imaginary part)

Card 3 (If IFLAG ≠ 1)

1-10	NTAB (M)	Number of tables

Card 4 (If IFLAG = 2)

1-20	TABL1	Electric field intensity
21-40	TABL2	Permittivity (real part)
41-60	TABL3	Permittivity (imaginary part)

Card 4 (If IFLAG = 3)

1-20	TABL1	Electric field intensity

21-40	TABL2	Electrical conductivity

Card 4(IFLAG=4)

1-20	TABL1	Temperature
21-40	TABL2	Electrical conductivity

Card 5

1-20	DUMMY	Unused

Card 6

1-20	DELEM (M)	Thickness of gap layers [m]

G-9. Electric Potential Specification (EL-ST, EL-FQ, EL-CUR)

Card 1

1-10	NUMFAI	Number of nodes for which electric potential is to be specified

Card 2

1-10	N	Order number
11-20	NPBCF (N)	Element ID
21-40	BCFAI (N)	Electric potential [V]

G-10. Electric Potential Boundary (CH)

Card 1

1-10	NGRPV	Number of groups for which electric potential boundary conditions are to be set
11-20	MXNPV	Maximum number of nodes
21-30	MXTBLV	Maximum number of tables

Card 2

1-10	NN	Group ID
11-20	NTBLV (NN)	Maximum number of tables in group
21-30	NUMPV2	Total nodes

Card 3

1-20	TBLV (1,N)	Time [sec]
21-40	TBLV (2,N)	Electric potential [V]

Card 4

1-10	NUMPV	Number of nodes in group

Card 5

1-10	NPV (1,NN)	Node ID
11-20	NPV (1,NN)	Node ID

G-11. Electric Field/Current Density Boundary

Card 1

1-10	NUMFLX	Number of elements for which electric potential boundary conditions are to be set

Card 2

1-10	N	Order ID
11-20	NBCFX (1,N)	Element ID
21-30	NCFLX (2,N)	Face ID
31-50	BCFLX (N)	Electric field value

G-12. Periodic Boundary (EL-ST, EL-FQ, EL-CUR, CH)

Card 1

1-10	NPERI	Number of node pairs on which periodic boundary conditions are to be imposed
11-20	ISYM2	=1: Periodic boundary condition =-1: Anti-periodic boundary condition

Card 2

1-20	PX	X-coordinate of a point on rotation axis
21-40	PY	Y-coordinate of a point on rotation axis
41-60	PZ	Z-coordinate of a point on rotation axis
1-20	AVX	X-component of rotation-axis vector (Note 1)
21-40	AVY	Y-component of rotation-axis vector (Note 1)
41-60	AVZ	Z-component of rotation-axis vector (Note 1)
61-80	ANGL	If |ISUM2| = 1, rotation angle [deg]

Card 3

1-10	N	Order number
11-20	NCYC1 (N)	Node on the first periodic boundary (Note 2)

Note 1: For translational symmetry, this data is neglected.

Note 2: Corresponding node must be found on the second periodic boundary.

G-13. Conductor (EL-ST, EL-FQ, EL-CUR, CH)

Card 1

1-10	NGRPC	Number of groups
11-20	MXGRPC	Maximum number of elements in group

Card 2

1-10	N	Group ID
11-20	NUMGC (N)	Number of elements in group

Card 3

1-10	NEC (1,N)	Element ID
11-20	NEC (2,N)	Element ID
71-80	NEC (NUMGC(N),N)	Element ID

G-14. Force Calculation (EL-ST, EL-FQ, EL-CUR, CH)

Card 1

1-10	NGRPF	Number of groups
11-20	MXGRPF	Maximum number of elements in group

Card 2

1-10	N	Group ID
11-20	NUMGF (N)	Number of elements in group

Card 3

1-10	NEF (1,N)	Element ID
11-20	NEF (2,N)	Element ID
71-80	NEF (NUMGF(N),N)	Element ID

G-15. Calculation of Surface Charge Distribution (EL-ST, EL-FQ, EL-CUR, CH)

Card 1

1-10	NGRPS	Number of groups on which surface charge is to be calculated
11-20	MXGRPS	Maximum number of elements in group

Card 2

1-10	NG	Group ID
11-20	NUMGS (NG)	Number of element in group

Card 3

1-10	I	Order ID
11-20	NEF (I,NG)	Element ID
21-30	NEF (I,NG)	Face ID

G-16. Surface Charge (EL-ST, EL-FQ, CH)

Card 1

1-10	NUMQS	Number of elements to which surface charge is to be given

Card 2

1-10	I	Order ID
11-20	NEQS (1,I)	Element ID
21-30	NEQS (2,I)	Face ID
31-50	QS (I)	Surface charge value [C/m^2]

G-17. Volume Charge (EL-ST, EL-FQ, CH)

Card 1

1-10	NUMQV	Number of elements to which (volume) charge is to be given

Card 2

1-10	I	Order ID
11-20	NEQV (I)	Element ID
21-40	QV (I)	Surface charge value [C/m^2]

G-18. Control Data of Charge Distribution Analysis (CH)

Card 1

1-10	NPART	Number of particle types

G-19. Transient Coefficient Matrix (CH)

Card 1

1-10	I	Row number of transient coefficient
11-20	J	Column number of transient coefficient
21-40	CMAT (I, J)	Component (i, j) of transient coefficient

G-20. Diffusion Coefficient (CH)

Card 1

1-10	NPART	Number of particle types

Card 2

1-20	DCOEF (1)	Diffusion coefficient of particle 1

G-21. Initial Particle Density (CH)

Card 1

1-10	NDNSO	Total number of nodes for which initial particle density is to be input

Card 2

1-10	NN	Order ID
11-20	NDONP	Node ID
21-30	NPTYP	Particle type number
31-50	DOVAL	Initial particle density [number/m^3]

G-22. Electric Discharge Current Calculation

Card 1

1-10	NGCRT	Electric discharge current calculation group
11-20	MAXFCE	Maximum number of elements in group

Card 2

1-10	NN	Group ID
11-20	MAXF	Number of elements in the NN group

Card 3

1-10	LCRTLM (1,1)	Element ID
11-20	LCRTLM (1,1)	Face ID
21-30	LCRTLM (2,1)	Element ID

G-23. Time Step Data

Card 1

1-10	NDATA	Number of time-step data

Card 2

1-20	TIME	Time [sec]
21-30	ITIME	Number of times electric field analysis is performed
31-40	ITMPLT	Analysis result output frequency

Appendix H. Plot File Format (Electric Field Analysis)

H-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

71-75	ID_SLV	Solver ID =1: Frequency response electric field analysis (EL) =5: Static electric field analysis (EL) =6: Current distribution analysis (EL) =7: Charge distribution analysis (CH) =8: Thermal analysis (HT) Response analysis (TD)
76-80	IVER	Version number (= 81)

Card 3

1-5	ISELECT	Analysis type =0: Static electric field analysis =1: Current distribution analysis =2: Charge distribution analysis =3: Electric field analysis (Frequency response)
6-10	NSTEP	Number of analysis steps
16-20	NEWTON	Number of nonlinear iterations
21-30	EPSITE	Nonlinear iterative convergence tolerance

H-2. Control Output Items

Card 1

1-10	N_CNT2	Number of lines in control card 2

Card 2

1-10	ACCEL	Accel parameter for ICCG
11-20	EPSPCG	Tolerance for ICCG
21-30	MAXPCG	Max iterations for ICCG

Card 3

1-20	PCGMAX	Unused
21-30	MICGRS	Unused

Card 4

Set the flag to 1 for output, and to 0 to disable output

1-5	IO_V	Electric potential (node data) output flag
6-10	IO_E	Electric field (element data) output flag
11-15	IO_P	Particle density (node data) output flag
16-20	IO_Q	Nodal density (node data) output flag
21-25	IO_J	Current (element data) output flag
26-30	IO_SFQ	Surface charge density (element data) output flag
31-35	IO_F	Nodal force (node data) output flag
36-40	IO_INQ	Internal charge (element data) output flag
41-45	IO_JL	Power consumption (element data) output flag
46-50	IO_TL	Thermal electromotive force loss (element data) output flag
51-55	IO_TTL	Total loss (element data) output flag

H-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	Number of lines

Card 2

1-10	MG_ON	Mesh generation execution flag
11-20	IBC_XY	Boundary condition flag for XY-plane
21-30	IBC_YZ	Boundary condition flag for YZ-plane
31-40	IBC_ZX	Boundary condition flag for ZX-plane

H-4. Step Control

Card 1

1-10	NSTPTP	Unused
11-20	NSTPFG	Unused

Card 2

1-10	NSTBL	Unused
11-20	TBLID	Unused

H-5. Control Output Interval

Card 1

1-10	N_OUT	Number of control output interval data of analysis results

Card 2

1-10	N	Order number
11-20	N_END(N)	Output interval control end step
21-30	N_STP(N)	Output interval up to the time N

Hereafter, it will be output in the case of frequency response electric field analysis. Although the parameters are the same as those of the magnetic field analysis, the contents will be output only in values shown in ().

Card 3

1-20	UNITOT	Unit of result verification
21-40	UNITIN	Unit of shape data
41-80	UNITNM	Unit label

H-6. Controlling PLOT File

Card 1

1-10	MAXPLT	Division size of plot file (MByte)

H-7. Output Conversion of Model

Card 1

1-10	IMODEL	Output flag for full model conversion =0: Not convert =1: Convert
11-20	ICOIL	Flag for specifying height of FEM coil =0: Height of FEM coil is the same as the thickness of model =1: Height of FEM coil differs from the thickness of model

Card 2

1-20	DTHICK	Thickness of model [m] Note: Available only for 2D analysis. Note: Not available for 3D analysis and axially-symmetric analysis.
21-40	VLNG	Height of FEM coil [m] Note: Available only for 2D analysis.
41-60	DIVMD	Division multiplier (Information on division created by dividers other than rotational periodic boundary.) Example: For one-to-nth division model, the output value is multiplied by n.
61-80	DDIVCY	Status information on division created by rotational periodic boundary

H-8. Parameter Conversion of Circuit

Card 1

1-10	NCMDL	Conversion flag =0: Partial model (Not convert to calculate) =1: Full model (Convert by using periodic boundary condition and division multiplier to calculate)
11-20	NN2	Connection status at the time of conversion =0: Series (Multiplier is applied to all calculation results of voltage.) =1: Parallel (Multiplier is applied to all calculation results of current passing through external circuit.)

Card 2

1-20	DIVCI	Division multiplier (Information on division created by dividers other than rotational periodic boundary.)

H-9. Coordinate Data

1-10	NUMNP	Total nodes
1-10	ICOUNT	Order number
11-20	ID	Node ID
21-40	X	X-coordinate
41-60	Y	Y-coordinate
61-80	Z	Z-coordinate

H-10. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	MAXNOD	Maximum number of nodes within element
11-15	NINT	Integral points

Card 2

1-8	M	Element ID
9-11	IEL(M)	Total nodes
12-14	MTYP(M)	Material ID
15-16	ETYP(M)	Element type =1: Solid hexahedron element (first coordinate) =2: Solid hexahedron element (second coordinate) =3: Solid tetrahedron element (first coordinate) =4: Solid tetrahedron element (second coordinate) =5: Solid pentahedron element (first coordinate) =6: Solid pentahedron element (second coordinate) =7: Shell element (first coordinate) =8: Shell element (second coordinate) =9: Beam element (first coordinate) =10: Beam element (second coordinate)
17-24	NOD(1,M)	Node ID (1)
25-32	NOD(2,M)	Node ID (2)
33-40	NOD(3,M)	Node ID (3)
41-48	NOD(4,M)	Node ID (4)
49-56	NOD(5,M)	Node ID (5)
57-64	NOD(6,M)	Node ID (6)
65-72	NOD(7,M)	Node ID (7)
73-80	NOD(8,M)	Node ID (8)

H-11. Analysis Results

H-11-1. Control Data

1-80	CONTROL_DATA	Header (3: Frequency response analysis, 2: Other analysis)
1-10	ISTEP	Analysis step number
11-30	TIME	Time

H-11-2. Displacement (Node Data)

(If there is translation)
(In the case of 1D equivalent model of electric charge distribution analysis)

1-80	DISPLACEMENT	Header (10001)
1-10	NUMD	Number of nodes with a value assigned to displacement
1-10	I	Order ID
11-20	NP	Node ID
21-40	DP (NP)	Displacement

H-11-3. Electric Potential (Node Data)

■ In the case of frequency response electric field analysis

1-80	NODAL_VOLTAGE	Header(4501)
1-10	NUMV	Number of nodes assigned with electric potential
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	NP	Node ID
21-40	VP (NP)	Electric potential (real part)
41-60	VP (NP)	Electric potential (imaginary part)

■ In the case of other analysis

1-80	NODAL_VOLTAGE	Header(2010)
1-10	NUMV	Number of nodes assigned with electric potential
1-10	I	Order ID

11-20	NP	Node ID
21-40	VP (NP)	Electric potential

H-11-4. Electric Field (Element Data)

(Output, if IO_E=1)

■ In the case of frequency response electric field analysis

1-80	ELECTRIC_FIELD	Header (19505)
1-10	NUMEF	Number of elements assigned with electric field
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	NE	Element ID
31-50	EFX(1, NE)	X-component of electric-field vector (real part)
51-70	EFX(2, NE)	Y-component of electric-field vector (real part)
71-90	EFX(3, NE)	Z-component of electric-field vector (real part)
91-110	EFX(1, NE)	X-component of electric-field vector (imaginary part)
111-130	EFX(2, NE)	Y-component of electric-field vector (imaginary part)
131-150	EFX(3, NE)	Z-component of electric-field vector (imaginary part)

■ In the case of other analysis

1-80	ELECTRIC_FIELD	Header (17016)
1-10	NUMEF	Number of elements assigned with electric field
1-10	I	Order ID
11-20	NE	Element ID
21-40	EFX (1,I)	X-component of electric-field vector
41-60	EFX (2,I)	Y-component of electric-field vector
61-80	EFX (3,I)	Z-component of electric-field vector

H-11-5. Particle Density (Node Data)

(Output, if ID_SLV = 7 and IO_P = 1)

1-80	PARTICLE_DENSITY	Header (2500)
1-10	NPART	Number of particle types
1-10	ICOUNT	Number of nodes assigned to output particle specified by NTYP
1-10	I	Order ID
11-20	NP	Node ID
21-40	DNS(NP,NTYP)	Particle density of particle specified by NTYP

*In the output of the initial state, the number of types of headers and particles will always be output.

H-11-6. Current (Element Data)

(Output, if ID_SLV = 6 or 1 and IO_J = 1)

1-80	CURRENT_DENSITY	Header (16503)
1-10	NUMJ	Number of elements with a value assigned to current
1-10	I	Order ID
11-20	NE	Element ID
21-40	CJ (1,NE)	X-component of current vector
41-60	CJ (2,NE)	Y-component of current vector
61-80	CJ (3,NE)	Z-component of current vector

■ **In the case of frequency response electric field analysis**

1-80	CURRENT_DENSITY	Header (19502)
1-10	NUMJ	Number of elements with a value assigned to current
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	NE	Element ID
31-50	CJ(1, NE)	X-component of current vector (real part)
51-70	CJ(2, NE)	Y-component of current vector (real part)
71-90	CJ(3, NE)	Z-component of current vector (real part)

91-110	CJ(1, NE)	X-component of current vector (imaginary part)
111-130	CJ(2, NE)	Y-component of current vector (imaginary part)
131-150	CJ(3, NE)	Z-component of current vector (imaginary part)

H-11-7. Surface Charge (Element Data)

(If ID_SLV = 1 or 5 or 7, and in addition, IO_SFQ = 1, it will be output)

1-80	SURFACE_CHARGE	Header (7503)
1-10	NUMFQ	Number of elements assigned with surface charge
1-10	I	Order ID
11-20	NE	Element ID
21-40	QFACE(NE)	Surface charge

H-11-8. Surface Charge (Step Data)

■ **In the case of frequency response electric field analysis**

1-80	SURFACE_CHARGE_PER_GROUP_R	Header (18202)
1-10	NUM_SQ	Number of surface-charge calculation groups
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-30	Q_S_R(I)	Surface charge (real part)
1-80	SURFACE_CHARGE_PER_GROUP_I	Header (18203)
1-10	NUM_SQ	Number of surface-charge calculation groups
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-30	Q_S_I(I)	Surface charge (imaginary part)

■ **In the case of other analysis**

1-80	SURFACE_CHARGE_PER_GROUP	Header (18201)
1-10	NUM_SQ	Number of surface-charge calculation groups
1-10	I	Order ID
11-30	Q_S (I)	Surface charge

H-11-9. Nodal Force (Node Data)

(Output, if IO_F = 1 and the number of output nodes > 0)

1-80	NODAL_FORCE	Header (11501)
1-10	NUMPF	Number of nodes assigned with nodal force
1-10	I	Order ID
11-20	NP	Node ID
21-40	PF (1,NP)	X-component of nodal force
41-60	PF (2,NP)	Y-component of nodal force
61-80	PF (3,NP)	Z-component of nodal force

* In the case of frequency response electric field analysis, the effective value will be output.

H-11-10. Force (Step Data)

(Output, if IO_F = 1 and the number of output nodes > 0)

1-80	FORCE&TORQUE_PER_GROUPHeader (601)	
1-10	NGRPF	Number of force calculation groups
1-10	I	Order ID
11-20	NG	Group ID
21-40	PF (1,NG)	X-component of force
41-60	PF (2,NG)	Y-component of force
61-80	PF (3,NG)	Z-component of force

* In the case of frequency response electric field analysis, the effective value will be output.

H-11-11.Total Currents (Step Data)

■ In the case of frequency response electric field analysis

1-80	TOTAL_CURRENT_R	Header (18101)
1-10	NUM_TJ	Number of current calculation groups
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order number
11-30	TC_J_R(I)	Current (real part)
1-80	TOTAL_CURRENT_I	Header (18151)
1-10	NUM_TJ	Number of current calculation groups
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order number
11-30	TC_J_I(I)	Current (imaginary part)

■ In the case of other analysis

1-80	TOTAL_CURRENT_	Header (18101)
1-10	NUM_TJ	Number of current calculation groups
1-10	I	Order number
11-30	TC_J (I)	Current

H-11-12.Internal Nodal Charge (Node Data)

(Output, if IO_INQ = 1 and the number of internal nodal charges > 0)

■ In the case of frequency response electric field analysis

1-80	POINT_CHARGE_	Header (4502)
1-10	NUM_Q	Number of internal nodal charges
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	LSHPT(I)	Node ID
21-40	QCHPT(I)	Internal nodal charge (real part)
41-60	QCHPT(I)	Internal nodal charge (imaginary part)

■ In the case of other analysis

1-80	POINT_CHARGE_	Header (In JMAG-Studio 8.0 it was 7504, in version 8.1 or later, it is 2503)
1-10	NUM_Q	Number of internal nodal charges
1-10	I	Order ID
11-20	LSHPT (I)	Node ID
21-40	QCHPT (I)	Internal nodal charge

H-11-13.Internal Line Charge (Element Data)

(Output, if IO_INQ = 1 and the number of internal line charges > 0)

■ In the case of frequency response electric field analysis

1-80	BEAM_CHARGE_	Header (6506)
1-10	NUM_BQ	Number of internal line charges
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	LSHLN(I)	Beam element ID
21-40	QCHLN(I)	Internal line charge (real part)
41-60	QCHLN(I)	Internal line charge (imaginary part)

■ **In the case of other analysis**

1-80	BEAM_CHARGE_	Header (In JMAG-Studio 8.0 it was 7505, in version 8.1 or later, it is 6501)
1-10	NUM_BQ	Number of internal line charges
1-10	I	Order ID
11-20	LSHLN(I)	Beam element ID
21-40	QCHLN(I)	Internal line charge

H-11-14.Internal Surface Charge (Element Data)

(Output, if IO_INQ = 1 and the number of internal surface charges > 0)

■ **In the case of frequency response electric field analysis**

1-80	SHELL_CHARGE_	Header (7560)
1-10	NUM_SQ	Number of internal surface charges
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	LSHSF(I)	Shell element ID
21-40	QCHSF(I)	Internal surface charge (real part)
41-60	QCHSF(I)	Internal surface charge (imaginary part)

■ **In the case of other analysis**

1-80	SHELL_CHARGE_	Header (In JMAG-Studio 8.0 it was 7506, in version 8.1 or later, it is 6502)
1-10	NUM_SQ	Number of internal surface charges
1-10	I	Order ID
11-20	LSHSF(I)	Shell element ID
21-40	QCHSF(I)	Internal surface charge

H-11-15.Internal Polarization (Element Data)

(Output, if IO_INQ = 1 and the number of internal polarization charges > 0)

■ In the case of frequency response electric field analysis

1-80	SOLID_DIPOLE_	Header (19515)
1-10	NUM_DQ	Number of internal polarization charges
11-20	FLAG	0
21-40	CONV	0.0
1-10	I	Order ID
11-20	LSHDP(I)	Solid element ID
21-40	QCHDP(1,I)	X-component of internal polarization (real part)
41-60	QCHDP(2,I)	Y-component of internal polarization (real part)
61-80	QCHDP(3,I)	Z-component of internal polarization (real part)
81-100	QCHDP(1,I)	X-component of internal polarization (imaginary part)
101-120	QCHDP(2,I)	Y-component of internal polarization (imaginary part)
121-140	QCHDP(3,I)	Z-component of internal polarization (imaginary part)

■ In the case of other analysis

1-80	SOLID_DIPOLE_	Header (In JMAG-Studio 8.0 it was 7507, in version 8.1 or later, it is 16508)
1-10	NUM_DQ	Number of internal polarization charges
1-10	I	Order ID
11-20	LSHDP(I)	Solid element ID
21-40	QCHDP(1,I)	X-component of internal polarization
41-60	QCHDP(2,I)	Y-component of internal polarization
61-80	QCHDP(3,I)	Z-component of internal polarization

H-11-16. Power Consumption Density (Element Data)

(Output, if ID_SLV=6 and IO_JL=1)

1-80	JOULE_LOSS	Header (7600)
1-10	NUMJL	Number of elements assigned with power consumption
1-10	I	Order ID
11-20	NE	Element ID
21-40	JOULOS(NE)	Power consumption

* It can be output as current distribution analysis using Seebeck coefficient.

H-11-17.Thermal Electromotive Force Loss Density (Element Data)

(Output, if ID_SLV=6 and IO_TL=1)

1-80	THERMAL_EMF_LOSS	Header (7610)
1-10	NUMTL	Number of elements assigned with thermal electromotive force loss
1-10	I	Order ID
11-20	NE	Element ID
21-40	THRLOS(NE)	Thermal electromotive force loss

* It can be output as current distribution analysis using Seebeck coefficient.

H-11-18.Total Losses Density (Element Data)

(Output, if ID_SLV=6 and IO_TTL=1)

1-80	TOTAL_LOSS	Header (7620)
1-10	NUMTL	Number of elements assigned with total loss
1-10	I	Order ID
11-20	NE	Element ID
21-40	TOTLOS(NE)	Total loss

* It can be output as current distribution analysis using Seebeck coefficient.

H-11-19. Power Consumption (Step Data)

(Output, if ID_SLV=6 and IO_JL=1)

1-80	JOULE_LOSS_PER_GROUPHeader (7630)	
1-10	NUMJL	Number of elements assigned with power consumption
1-10	I	Order ID
11-20	MT	Material ID
21-40	TJLOSM(MT)	Power consumption

* It can be output as current distribution analysis using Seebeck coefficient.

H-11-20.Thermal Electromotive Force Loss (Step Data)

(Output, if ID_SLV=6 and IO_TL=1)

1-80	THERMAL_EMF_LOSS_PER_GROUPHeader (7640)	
1-10	NUMTL	Number of elements assigned with thermal electromotive force loss
1-10	I	Order ID
11-20	MT	Material ID
21-40	THLOSM(MT)	Thermal electromotive force loss

* It can be output as current distribution analysis using Seebeck coefficient.

H-11-21.Total Loss (Step Data)

(Output, if ID_SLV=6 and IO_TTL=1)

1-80	TOTAL_LOSS_PER_GROUPHeader (7650)	
1-10	NUMTL	Number of elements assigned with total loss
1-10	I	Order ID
11-20	MT	Material ID
21-40	TTLOSM(MT)	Total loss

* It can be output as current distribution analysis using Seebeck coefficient.

Appendix I. Solver Data File Format (Electromagnetic Wave Frequency Response Analysis)

I-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

71-75	ID_SLV	Solver ID =9: Electromagnetic Wave Frequency Response Analysis (WV)
76-80	IVER	Version number (= 70)

Card 3

1-5	IDYN	=0 (Unused)
6-10	NSTEP	Number of analysis steps
16-20	NEWTON	=0 (Unused)
21-30	EPSITE	=0 (Unused)
31-35	IXYZ	=1 (Unused)

Card 4

1-10	N_CNT2	=5

Card 5

1-10	MATRIX_SOLVER	Matrix solver type =0: Direct method =1: Iteration method =2: GCR method
11-20	ITERATOVE_TYPE	Linear solver type =0: Conjugate gradient (CG) method =1: GCR method =2: GMRES method
21-30	PRECONDITIONER	Matrix preconditioner =0: No preconditioner =1: SSOR method

31-40	IN/OUT_CORE	In core/Out of core =0: In core =1: Out of core

Card 6

1-20	ACCEL	Accel parameter for ICCG
21-40	EPSPCG	Tolerance for ICCG
41-60	PCGMAX	Calculation aborting tolerance for ICCG
61-70	MAXPCG	Max iteration for ICCG
71-80	RESTART	Restart parameter when using the GCR and GMRES methods

Card 7

1-10	MICCG	=0: Unused
11-20	MICGRS	=0: Unused
21-30	MPHAI	=0: Unused
31-40	MMTRIX	=0: Unused

Card 8

1-10	MULTIGRID_LEVEL	Usage level used in the Multigrid method
11-20	MULTIGRID_SMOOTH	Smoothing parameter used in the Multigrid method
21-30	MULTIGRID_TYPE	Cycle type used in the Multigrid method (When used with the GMG or Hybrid methods) =0: V cycle =1: W cycle
31-40	TYPE_FLAG	Types of the Multigrid method =0: GMG (the geometrical Multigrid method) =1: AMG (the algebraic Multigrid method) =2: Hybrid (GMG + AMG)
41-50	COARSEST_MESH	=1000: Default value

Card 9

1-10	ADAPTIVE_LEVEL	Adaptive maximum division level
11-30	ADAPTIVE_ERROR	Adaptive acceptable-error range

31-50	ADAPTIVE_THRESHOLDAdaptive division sensitivity	

I-2. Output Item Control

Card 1

Set the flag to 1 for output, and to 0 for disabling output.

1-5	IO_EL	Electric field (element data) output flag
6-10	IO_MG	Magnetic field (element data) output flag
11-15	IO_CR	Current density (element data) output flag
16-20	IO_JL	Joule loss density (element data) output flag
21-25	IO_EN	Stored energy (element data) output flag (Unused)
26-30	ISCAT	Only scattering field output flag (under external field conditions)
31-35	IO_FLUX	Magnetic flux density (element data) output flag
36-40	IO_ERROR	Analysis error (element data) output flag

I-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	=1

Card 2

1-10	MG_ON	=0: Unused
11-20	IBC_XY	=0: Unused
21-30	IBC_YZ	=0: Unused
31-40	IBC_ZX	=0: Unused

I-4. Step Control

Card 1

1-10	NSTPTP	=0: Unused
11-20	NSTPFG	=0: Unused

Card 2

1-10	NICGG	=0: Unused
11-20	MXICGP	=0: Unused

I-5. Output Interval Control

Card 1

1-10	N_OUT	=0: Unused

I-6. Coordinate Data

Card 1

1-10	NUMNP	Total nodes

Card 2 (Repeat up to the number of NUMNP.)

1-10	I	Order ID
11-20	N	Node ID
21-40	X (N)	X-coordinate [m]
41-60	Y (N)	Y-coordinate [m]
61-80	Z (N)	Z-coordinate [m]

I-7. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	MAXNOD	=0: Unused
11-15	NINT	=0: Unused

Card 2 (Repeat up to the number of NUMEL)

1-8	M	Element ID
9-11	IEL	Total nodes
12-14	MTYP	Material ID
15-16	ETYP	Element type =1: Solid hexahedron element (first coordinate) =2: Solid hexahedron element (second coordinate) =3: Solid tetrahedron element (first coordinate) =4: Solid tetrahedron element (second coordinate) =5: Solid pentahedron element (first coordinate) =6: Solid pentahedron element (second coordinate) =7: Shell element (first coordinate) =8: Shell element (second coordinate) =9: Beam element (first coordinate) =10: Beam element (second coordinate)
17-24	NOD (1)	Node ID
25-32	NOD (2)	Node ID
33-40	NOD (3)	Node ID
31-48	NOD (4)	Node ID
49-56	NOD (5)	Node ID
57-64	NOD (6)	Node ID
65-72	NOD (7)	Node ID
73-80	NOD (8)	Node ID

I-8. Material Property Data

Card 1

1-10	NUMAT	Number of material property types
11-20	MAXTP	=0: Unused
21-30	MAXTPC	=0: Unused

* Repeat the following input sequence up to the number of NUMAT.

Card 2

1-10	MATID	Material ID
11-20	0	Unused
21-30	0	Unused
31-40	0	Unused

Card 3

1-10	IFLAG (M)	Type of specifying permeability =1: Linear material (constant-complex permeability) =13: Nonlinear material (frequency-complex permeability) =14: Nonlinear material (temperature-complex permeability)
11-20	IFLAGC (M)	Type of specifying permittivity =0: Linear material (constant-complex permittivity) =1: Linear material (constant-complex permittivity and electrical conductivity) =13: Nonlinear material (frequency-complex permittivity) =14: Nonlinear material (temperature-complex permittivity)
31-40	MTOUT (M)	Output flag =0: Output =1: Not output
41-50	MTGAP (M)	=0: Unused
51-80	NAME (M)	Material property name

Card 4 (If IFLAG = 1)

1-20	CMU_R (M)	Permeability (real part)
21-40	CMU_I (M)	Permeability (imaginary part)

Card 4 (If IFLAG = 13 or 14)

1-10	NTAB (M)	Number of points in magnetization table (If IFLAG = 13) Number of points in temperature table (If IFLAG = 14)

Card 5 (If IFLAG = 13 or 14, repeat up to the number of NTAB (M))

1-10	IP	Order number
11-30	FREQ (IP, M) / TEMP (IP, M)	Frequency (Hz) (If IFLAG = 13) Temperature [Celsius] (If IFLAG = 14)
31-50	CMU_R (IP, M)	Permeability (real part)
51-70	CMU_I (IP, M)	Permeability (imaginary part)

Card 5 (If IFLAGC = 0: Skip to Card 6 if IFLAG = 13 or 14)

1-20	EPS_R (M)	Permittivity (real part)
21-40	EPS_I (M)	Permittivity (imaginary part)

Card 5 (If IFLAGC = 1: Skip to Card 6 if IFLAG = 13 or 14)

1-20	EPS (M)	Permittivity (real part)
21-40	SIGMA (M)	Electrical conductivity [1/(ohm·m)]

Card 5 (If IFLAGC = 13 or 14: Skip to Card 6 if IFLAG = 13 or 14)

1-10	NTABC (M)	Number of magnetization tables (If IFLAG = 13) Number of temperature tables (If IFLAG = 14)

Card 6 (If IFLAGC = 13 or 14: Skip to Card 7 if IFLAG = 13 or 14. Repeat up to the number of NTABC (M).)

1-10	IP	Order number
11-30	FREQ (IP, M) / TEMP (IP, M)	Frequency [Hz] (If IFLAGC = 13) Temperature [Celsius] (If IFLAGC = 14)
31-50	EPS_R (IP, M)	Permittivity (real part)
51-70	EPS_I (IP, M)	Permittivity (imaginary part)

I-9. Scalar Potential Boundary

Card 1

1-10	NSCPOT	=0: Unused

I-10. Perfect Electric Boundary (PEC)

Card 1

1-10	PECGRP	Number of element face groups which perfect electric boundary conditions are to be set

* When PECGRP > 0, input data, and repeat the following input sequence up to the number of PECGRP.

Card 2

1-10	PECID	Group ID
11-20	NUMPEC	Number of element faces in group which perfect electric boundary conditions are to be set

Card 3 (Repeat up to the number of NUMPEC)

1-10	I	Order ID
11-20	NEDBC (I)	Element ID
21-30	NFDBC (I)	Element face ID

I-11. Perfect Magnetic Boundary (Natural Boundary)

Card 1

1-10	PMCGRP	Number of element face groups which magnetic wall conditions are to be set

* When PECGRP > 0, input data, and repeat the following input sequence up to the number of PECGRP.

Card 2

1-10	PMCID	Group ID

Card 3

1-10	NUMPMC	Number of element faces in group which magnetic wall conditions are to be set

Card 4 (Repeat up to the number of NUMPMC)

1-10	I	Order ID
11-20	NEDBM (I)	Element ID
21-30	NFDBM (I)	Element face ID

I-12. Periodic Boundary

Card 1

1-10	NPERIGRP	Number of periodic boundary condition groups

* When NPERIGRP > 0, input data, and repeat the following input sequence up to the number of NPERIGRP.

Card 2

1-10	NPERI	Number of node pairs on which periodic boundary conditions are to be imposed
11-20	ISYM2	>0: Periodic boundary =+1: Rotational symmetry =+2: Translational symmetry <0: Anti-periodic boundary =-1: Rotational symmetry =-2: Translational symmetry

Card 3

1-20	PX	X-coordinate of a point on rotation axis (See Note 1)
21-40	PY	Y-coordinate of a point on rotation axis (See Note 1)
41-60	PZ	Z-coordinate of a point on rotation axis (See Note 1)

Card 4

(If |ISYM2| = 1)

1-20	AVX	X-component of rotation-axis vector
21-40	AVY	Y-component of rotation-axis vector
41-60	AVZ	Z-component of rotation-axis vector
61-80	ANGL	Rotation angle [deg]

(If |ISYM2| = 2)

1-20	AVX	X-component of translation-direction vector
21-40	AVY	Y-component of translation-direction vector
41-60	AVZ	Z-component of translation-direction vector
61-80	ANGL	Translation distance [m]

Card 5

1-20	DUMY	=0: Unused
21-40	DUMY	=0: Unused
41-60	DUMY	=0: Unused
61-80	DUMY	=0: Unused

Card 6 (Repeat up to the number of NPERI)

1-20	N	Order number
21-40	NCYC1 (N)	Node on the first periodic boundary (See Note 2)

Note 1: For translational symmetry, this data is neglected.

Note 2: Corresponding node should be found on the second periodic boundary.

I-13. Transparent Boundary (Absorbing Boundary)

Card 1

1-10	NGRPAT	Number of groups
11-20	MXNGAT	=0: Unused
21-30	MXTPA	=0: Unused
31-41		=0: Unused

* When NGRPAT > 0, input data, and repeat the following input sequence up to the number of NGRPAT.

Card 2

1-10	N	Group ID
11-30	PRCNT (N)	Propagation constant

Card 3

1-10	NGAT (N)	Number of element faces in group

Card 4 (Repeat up to the number of NGAT (I))

1-10	I	Order ID
11-20	NEAT (I)	Element ID
21-30	NFAT (I)	Element face ID

I-14. PML Boundary

Card 1

1-10	PMLGRP	Number of groups

* When PMLGRP > 0, input data, and repeat the following input sequence up to the number of PMLGRP.

Card 2

1-10	PMLID	Group ID
11-20	PMLX	Flag for absorbing in X-axis direction =0: Not absorbed =1: Absorbed
21-30	PMLY	Flag for absorbing in Y-axis direction =0: Not absorbed =1: Absorbed
31-40	PMLZ	Flag for absorbing in Z-axis direction =0: Not absorbed =1: Absorbed

Card 3

1-20	ALPHA	Absorption parameter α at PML boundary
21-40	BETA	Absorption parameter β at PML boundary
41-50	MTOUT	PML region output flag =0: Not output =1: Output

Card 4

1-10	NUMPML	Number of element face groups which symmetry boundary conditions are to be set

Card 5 (Repeat up to the number of NUMPML.)

1-10	I	Order ID
11-20	NEPML (I)	Element ID
21-30	NFPML (I)	Element face ID

I-15. Surface Impedance Boundary

Card 1

1-10	NSIBC	Number of groups

* When NSIBC > 0, input data, and repeat the following input sequence up to the number of NSIBC.

Card 2

1-10	ISIBC	Group ID
11-20	SIBCTYPE (ISIBC)	Type of specifying surface impedance =0: Specify by relative permeability and electrical conductivity =1: Specify by surface impedance

(If specification type = 0)

21-40	MU (ISIBC)	Relative permeability
41-60	SIGMA (ISIBC)	Electrical conductivity [1/(ohm·m)]

(If specification type = 1)

21-40	SIMP_R (ISIBC)	Surface impedance (real part)
41-60	SIMP_I (ISIBC)	Surface impedance (imaginary part)

Card 3

1-10	SFACE (ISBC)	Number of element faces in group

Card 4 (Repeat up to the number of SPACE (SIBC).)

1-10	I	Order ID
11-20	SFACE_E (I, ISIBC)	Element ID
21-30	SFACE_F (I, ISIBC)	Face ID

I-16. In/Out Port

Card 1

1-10	NGRPIN	Number of groups
11-20	MXNGIN	=0: Unused

* When NGRPIN > 0, input data, and repeat the following input sequence up to the number of NGRPIN.

Card 2

1-10	N	Group ID
11-20	INCTYPE	Incidence mode flag
		=0: Plane wave
		=1: User subroutine
		=2: Modal port
21-30	MODIN (N)	Mode number

(If incidence mode flag = 0)

		=-1: Wave polarized in X-axis direction
		=-2: Wave polarized in Y-axis direction
		=-3: Wave polarized in Z-axis direction

(If incidence mode flag = 1)

		(Use as the number of user subroutine function.)

(If incidence mode flag = 2)

		=-1: Rectangular waveguide
		=-2: Cylindrical coaxial guide
		=-3: Microstrip line
31-50	BETA (N)	Propagation constant
51-70	AMPIN (N)	Intensity [W]
71-80	EXCT	Input port flag
		=0: Not use for input port
		=1: Use for input port

(Input only when incidence mode flag = 2.)

Card 2-1

(If mode number = -1)

1-20	PX1	Origin of rectangular waveguide (lower left) (X-coordinate)
21-40	PY1	Origin of rectangular waveguide (lower left) (Y-coordinate)
41-60	PZ1	Origin of rectangular waveguide (lower left) (Z-coordinate)

(If mode number = -2)

1-20	PX1	Center of cylindrical coaxial cable (X-coordinate)
21-40	PY1	Center of cylindrical coaxial cable (Y-coordinate)
41-60	PZ1	Center of cylindrical coaxial cable (Z-coordinate)

(If mode number = -3)

1-20	PX1	A point on microstrip line (X-coordinate)
21-40	PY1	A point on microstrip line (Y-coordinate)
41-60	PZ1	A point on microstrip line (Z-coordinate)

(Input only when incidence mode flag = 2.)

Card 2-2

(If mode number = -1)

1-20	PX2	A point (1) of rectangular waveguide (width direction) (X-coordinate)
21-40	PY2	A point (1) of rectangular waveguide (width direction) (Y-coordinate)
41-60	PZ2	A point (1) of rectangular waveguide (width direction) (Z-coordinate)

(If mode number = -2)

1-20	PX2	A point on the inner circle of cylindrical coaxial cable (X-coordinate)

21-40	PY2	A point on the inner circle of cylindrical coaxial cable (Y-coordinate)
41-60	PZ2	A point on the inner circle of cylindrical coaxial cable (Z-coordinate)

(If mode number = -3)

1-20	PX2	Another point (2) on microstrip line (X-coordinate)
21-40	PY2	Another point (2) on microstrip line (Y-coordinate)
41-60	PZ2	Another point (2) on microstrip line (Z-coordinate)

(Input only when incidence mode flag = 2.)

Card 2-3

(If mode number = -1)

1-20	PX3	Another point (2) of rectangular waveguide (height direction) (X-coordinate)
21-40	PY3	Another point (2) of rectangular waveguide (height direction) (Y-coordinate)
41-60	PZ3	A point (1) of rectangular waveguide (height direction) (Z-coordinate)

(If mode number = -2)

1-20	PX3	A point on the outer circle of cylindrical coaxial cable (X-coordinate)
21-40	PY3	A point on the outer circle of cylindrical coaxial cable (Y-coordinate)
41-60	PZ3	A point on the outer circle of cylindrical coaxial cable (Z-coordinate)

(If mode number = -3)

1-20	PX3	A point on ground plane (X-coordinate)
21-40	PY3	A point on ground plane (Y-coordinate)
41-60	PZ3	A point on ground plane (Z-coordinate)

(Input only when incidence mode flag = 2.)

Card 2-4

(If mode number = -1, -2)

1-10	TEM	Mode number of TEM mode (Use only when mode number = -2)
11-20	TE	Mode number of TE mode
21-30	TM	Mode number of TM mode

(If mode number = -3)

1-10	MATID	Dielectric layer material ID
11-20	MATNAME	Dielectric layer material name

Card 3

1-10	IELEM	Number of element faces in group

Card 4 (Repeat up to the number of IELEM.)

1-10	I	Order number
11-20	NGIN (I)	Element ID
21-30	NFIN (I)	Element face ID

I-17. Lumped Constant Component

Card 1

1-10	NG	Number of groups
11-20	DUMY	=0: Unused

Card 2

1-10	SID	Order number
11-20	CTYPE (SID)	Component type
		=0: Impedance [ohm]
		=1: Resistance [ohm]
		=2: Coil [H]
		=3: Condenser [F]
21-40	ZR (SID)	Lumped constant component (real part)
41- 1	ZI (SID)	Lumped constant component (imaginary part)

Card 3

1-10	NE (SID)	Number of elements composing a lumped constant component

Card 4

1-10	I (SID)	Order ID
11-20	E (SID, I)	Element ID

I-18. External Field (Line)

*See Note 1

Card 1

1-10	DUMY	=0: Unused
11-20	DUMY	=0: Unused

Card 2

1-10	NGRPD	Number of groups
11-20	MXNGED	=0: Unused
21-30	MXTBLD	=0: Unused

* When NGRPD > 0, input data, and repeat the following input sequence up to the number of NGRPD.

Card 3

1-10	IGRP	Group ID
11-20	NUMGD (IGRP)	Number of elements in group
21-30	NTBLD (IGRP)	Number of current density tables in group
31-40	ICHCD (IGRP)	=1: Unused
41-50	INDEX (IGRP)	=1: Unused
51-60	ISDFG (IGRP)	=0: Unused
61-70	NCYTM (IGRP)	=1: Unused

Card 4 (Repeat up to the number of NTBLD (IGRP))

1-20	TBLD (I, IGRP)	Frequency [Hz]
21-40	TBLD (I+1,IGRP)	Current (real part) [A]
41-60	TBLD (I+2,IGRP)	Current (imaginary part) [A]

Card 5 (Repeat up to the number of NUMGD (IGRP))

1-10	I	Order ID
11-20	NE (I,IGRP)	Element ID
21-40	DVX	=0: Unused
41-60	DVY	=0: Unused
61-80	DVZ	=0: Unused

Note 1: These items of data can be set only for beam element.

I-19. Voltage/Current Excitation

*See Note 1

Card 1

1-10	NGRP	Number of groups
11-20	MXNGE	=0: Unused
21-30	MXTBL	=0: Unused

* When NGRP > 0, input data, and repeat the following input sequence up to the number of NGRP.

Card 2

1-10	IGRP	Group ID
11-20	IDUMMY	=0: Unused
21-30	ITECT (IGRP)	Voltage/Current identification flag =0: Voltage =1: Current

Card 3

1-10	NTBLD (IGRP)	Number of current tables in group

Card 4 (Repeat up to the number of NTBLD (IGRP))

1-10	I	Order ID
11-30	EXCTF (I, N)	Frequency [Hz]
31-50	EXCTR (I, N)	Electric filed (real part) [V/m]
51-70	EXCTI (I, N)	Electric filed (imaginary part) [V/m]

Card 5

1-10	NUMGE (IGRP)	Number of elements in group

Card 6 (Repeat up to the number of NTBLD (IGRP))

1-10	I	Order ID
11-20	NE (I, IGRP)	Element ID

Note 1: These items of data can be set only for beam element.

I-20. Laser Beam

Card 1

1-10	NLBC	Number of laser beam condition settings (= 0, 1)
11-20	DUMMY	

Card 2

1-10	BTYP	Beam type = 0: Specifying beam according to scalar field theory = 1: Specifying beam according to vector field theory = 2: Use data file

Card 3

1-20	POX	X-component of polarized wave vector
21-40	POY	Y-component of polarized wave vector
41-60	POZ	Z-component of polarized wave vector

Card 4

1-20	DIRX	X-component of propagation vector
21-40	DIRY	Y-component of propagation vector
41-60	DIRZ	Z-component of propagation vector

Card 5

1-20	OX	X-coordinate of focal point
21-40	OY	Y-coordinate of focal point
41-60	OZ	Z-coordinate of focal point

Card 6

1-10	STYP	Spot size selection flag = 0: Specify spot size = 1: Specify numerical aperture
11-30	SSZ	Spot size or open area ratio

Card 7

1-10	ITYP	Intensity type = 0: Specify by output power

		= 1: Specify by electric field intensity
11-30	IVL	Intensity value

Card 8

1-80	FILENAME	External file name

Card 9

1-20	DUMMY
21-40	DUMMY
41-60	DUMMY

Card 10

1-20	DUMMY
21-40	DUMMY
41-60	DUMMY

Card 11

1-20	DUMMY
21-40	DUMMY
41-60	DUMMY

I-21. Plasma Calculation

Card 1

1-10	NPLS	Plasma Condition (=1)

*Repeat NPLS for the following

Card 2

1-10	MAXITR	Plasma calculation maximum iteration
11-30	PLSEPS	Plasma calculation conversion tolerance
31-40	IPLOT	Initial plasma density plot file flag

Card 3

1-10	NPLSM	Plasma calculation region elements

Card 4

1-10	N	Order ID
11-20	IPLSM(N)	Element ID

Card 5

1-10	NPLSG	Plasma generation region elements

Card 6

1-10	N	Order ID
11-20	IPLSG(N)	Element ID

Card 7

1-10	NPLSN	Ungenerated plasma region elements

Card 8

1-10	N	Order ID
11-20	IPLSN(N)	Element ID

I-22. External Field

Card 1

1-10	BEXT	External field use flag =0: Not use =1: Use
11-20	LUEXT	User subroutine *extusr* use flag =0: Not use =1: Use

* When BEXT = 1, input the items of the following cards.

Card 2

1-20	PX	X-component of polarized wave vector [V/m]
21-40	PY	Y-component of polarized wave vector [V/m]
41-60	PZ	Z-component of polarized wave vector [V/m]

Card 3

1-20	DIRX	X-component of direction vector
21-40	DIRY	Y-component of direction vector
41-60	DIRZ	Z-component of direction vector

I-23. Equivalent Current Calculation Surface

Card 1

1-10	NOBSER	Number of element faces to which calculation surface is to be set

* When NOBSER > 0, input data, and repeat the following input sequence to the number of NOBSER.

Card 2

1-10	N	Order ID
11-20	NEDOB (N)	Element ID
21-30	NFDOB (N)	Face ID

I-24. Transmitted Power Calculation

Card 1

1-10	NGRPF	Number of groups of which transmitted power is to be calculated
11-20	MAXNGF	=0: Unused

* When NGROUP > 0, input data, and repeat the following input sequence up to the number of NGRPF.

Card 2

1-10	IGRP	Group ID
11-20	NUMGE (IGRP)	Number of element faces in group

Card 3 (Repeat up to the number of NUMGE (IGRP).)

1-10	I	Order ID
11-20	NGE (I, NG)	Element ID
21-30	NGF (I, NG)	Face ID

I-25. Transmitted Current Calculation

Card 1

1-10	NGRPCUR	Number of beam element groups for which transmitted current is calculated

* When NGRPCUR > 0, input data, and repeat the following input sequence up to the number of NGRPCUR.

Card 2

1-10	IGRP	Group ID
11-20	NUME (IGRP)	Number of elements in group

Card 3 (Repeat up to the number of NUME (IGRP))

1-10	I	Order ID
11-20	NE(I)	Element ID

I-26. Voltage Calculation

Card 1

1-10	NGRPVOL	Number of beam element groups for which voltage is to be calculated

* When NGRPVOL > 0, input data, and repeat the following input sequence up to the number of NGRPVOL.

Card 2

1-10	IGRP	Group ID
11-20	NUME (IGRP)	Number of elements in group

Card 3 (Repeat up to the number of NUME (IGRP))

1-10	I	Order ID
11-20	NE (I)	Element ID

I-27. Step Data

Card 1

1-10	IDUMMY	=0: Unused
11-20	IDUMMY	=0: Unused

Card 2

1-10	NDATA	Number of step data
11-20	NDIV	Number of divisions
21-30	ST	Sweep type =0: Automatic =1: Manual

Card 3 (Repeat up to the number of NDATA)

1-20	FREQ	Frequency [Hz]
21-30	ITEMA	=0: Unused

Card 4

1-10	MH	Maximum number of hops
11-20	ME	Maximum expansion number
21-30	S	Expansion data save flag =0: Not save =1: Save

Appendix J. PLOT File Format (Electromagnetic Wave Frequency Response Analysis)

J-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

71-75	ID_SLV	Solver ID =9: Electromagnetic Wave Frequency Response Analysis (WV)
76-80	IVER	Version number (= 60)

Card 3

1-5	IDYN	=0: Unused
6-10	NSTEP	Number of analysis steps
16-20	NEWTON	=0: Unused
21-30	EPSITE	=0: Unused
31-35	IXYZ	=1: Unused

Card 4

1-10	N_CNT2	=5

Card 5

1-10	MATRIX_SOLVER	Matrix solver type =0: Direct method =1: Iterative Method =2: GCR
11-20	ITERATOVE_TYPE	Linear solver type =0: Conjugate gradient method =1: GCR =2: GMRES
21-30	PRECONDITIONER	Matrix preconditioner =0: No preconditioner =1: SSOR

Card 6

1-20	ACCEL	Accel parameter for ICCG
21-40	EPSPCG	Tolerance for ICCG
41-60	PCGMAX	Calculation aborting tolerance for ICCG
61-70	MAXPCG	Max iteration for ICCG
71-80	RESTART	Restart parameter when using the GCR and GMRES methods

Card 7

1-10	MICCG	=0: Unused
11-20	MICGRS	=0: Unused
21-30	MPHAI	=0: Unused
31-40	MMTRIX	=0: Unused

Card 8

1-10	MULTIGRID_LEVEL	Usage level used in the Multigrid method
11-20	MULTIGRID_SMOOTH	Smoothing parameter used in the Multigrid method
21-30	MULTIGRID_TYPE	Cycle type used in the Multigrid method =0: V cycle =1: W cycle

Card 9

1-10	ADAPTIVE_LEVEL	Adaptive maximum division level
11-30	ADAPTIVE_ERROR	Adaptive acceptable error range

J-2. Control Output Items

Card 1

Set the flag to 1 for output, and to 0 for disabling output

1-5	IO_EL	Electric field (element data) output flag
6-10	IO_MG	Magnetic field (element data) output flag
11-15	IO_CR	Current density (element data) output flag
16-20	IO_JL	Joule loss density (element data) output flag
21-25	IO_EN	Stored energy (element data) output flag (Unused)
26-30	ISCAT	Only scattering field output flag (under external field conditions)
31-35	IO_FLUX	Magnetic flux density (element data) output flag
36-40	IO_ERROR	Analysis error (element data) output flag

J-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	=1

Card 2

1-10	MG_ON	=0: Unused
11-20	IBC_XY	=0: Unused
21-30	IBC_YZ	=0: Unused
31-40	IBC_ZX	=0: Unused

J-4. Step Control

Card 1

1-10	NSTPTP	=0: Unused
11-20	NSTPFG	=0: Unused

Card 2

1-10	NICGG	=0: Unused
11-20	MXICGP	=0: Unused

J-5. Control Output Interval

Card 1

1-10	N_OUT	=0: Unused

J-6. Coordinate Data

Card 1

1-10	NUMNP	Total nodes

Card 2 (Repeat up to the number of NUMNP.)

1-10	I	Order ID
11-20	N	Node ID
21-40	X (N)	X-coordinate [m]
41-60	Y (N)	Y-coordinate [m]
61-80	Z (N)	Z-coordinate [m]

J-7. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	MAXNOD	=0: Unused
11-15	NINT	=0: Unused

Card 2 (Repeat up to the number of NUMEL)

1-8	M	Element ID
9-11	IEL	Total nodes
12-14	MTYP	Material ID
15-16	ETYP	Element type =1: Solid hexahedron element (first coordinate) =2: Solid hexahedron element (second coordinate) =3: Solid tetrahedron element (first coordinate) =4: Solid tetrahedron element (second coordinate) =5: Solid pentahedron element (first coordinate) =6: Solid pentahedron element (second coordinate) =7: Shell element (first coordinate) =8: Shell element (second coordinate) =9: Beam element (first coordinate) =10: Beam element (second coordinate)
17-24	NOD (1)	Node number
25-32	NOD (2)	Node number
33-40	NOD (3)	Node number
31-48	NOD (4)	Node number
49-56	NOD (5)	Node number
57-64	NOD (6)	Node number
65-72	NOD (7)	Node number
73-80	NOD (8)	Node number

J-8. Analysis Results

J-8-1. Control Data

1-80	HEADER	Header CONTRO_DATA Item number 3
1-10	ISTEP	Analysis step number
11-30	FREQ	Frequency

J-8-2. Magnetic Field

(Element Data, Complex Numbers, and Vector Values)

1-80	HEADER	Header MAGNETIC_FIELD Item number 19508
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NP (I)	Element ID
21-40	HX (I)	X-component of magnetic field (real part)
41-60	HY (I)	Y-component of magnetic field (real part)
61-80	HZ (I)	Z-component of magnetic field (real part)
81-100	HX (I)	X-component of magnetic field (imaginary part)
101-120	HY (I)	Y-component of magnetic field (imaginary part)
121-140	HZ (I)	Z-component of magnetic field (imaginary part)

J-8-3. Electric Field

(Element Data, Complex Numbers, and Vector Values)

1-80	HEADER	Header ELECTRIC_FIELD Item number 19505
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Element ID
21-40	EX (I)	X-component of electric field (real part)
41-60	EY (I)	Y-component of electric field (real part)
61-80	EZ (I)	Z-component of electric field (real part)

81-100	EX (I)	X-component of electric field (imaginary part)
101-120	EY (I)	Y-component of electric field (imaginary part)
121-140	EZ (I)	Z-component of electric field (imaginary part)

J-8-4. Current Density

(Element Data, Complex Numbers, and Vector Values)

1-80	HEADER	Header EDDY_CURRENT_DENSITY
		Item number 19502
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NP (I)	Element ID
21-40	JX (I)	X-component of current density (real part)
41-60	JY (I)	Y-component of current density (real part)
61-80	JZ (I)	Z-component of current density (real part)
81-100	JX (I)	X-component of current density (imaginary part)
101-120	JY (I)	Y-component of current density (imaginary part)
121-140	JZ (I)	Z-component of current density (imaginary part)

J-8-5. Joule Loss Density

(Element Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header CURRENT_LOSS
		Item number 7501
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NE	Element ID
21-40	LOD (1, NE)	Joule loss density

J-8-6. SAR

(Element Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header SAR
		Item number 7603
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NE	Element ID
21-40	LOD (1, NE)	SAR

J-8-7. Hysteresis Loss Density

(Element Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header HYSTERESIS_LOSS
		Item number 7602
1-10	NUM	Number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NE	Element ID
21-40	LOH (1, NE)	Hysteresis loss density

J-8-8. Joule Loss

(Step Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header JOULE_LOSS_PER_GROUP
		Item number 501
1-10	NLOSS	Total number of Joule loss calculation groups

* Repeat the following input sequence up to the number of groups.

1-10	IGL	Group ID
11-30	TLOSS (IGL)	Joule loss
31-50	Unused	

J-8-9. Hysteresis Loss

(Step Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header HYSTERESIS_LOSS_PER_GROUP Item number 551
1-10	NLOSS	Total number of Hysteresis loss calculation groups

* Repeat the following input sequence up to the number of groups.

1-10	IGL	Group ID
11-30	TLOSS_H (IGL)	Hysteresis loss
31-50	Unused	

J-8-10. Stored Energy

(Step Data, Real Numbers, and Scalar Values)

1-80	HEADER	Header STORED_ENERGY Item number 801
1-10	NUMGT	Total number of energy calculation groups (Number of material properties + 1)

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	ENE (IGT)	Energy (The content of the NUMGT item is the sum of energies listed above.)

J-8-11. Transmitted Power

(Step Data, Complex Numbers, and Scalar Values)

1-80	HEADER	Header FLUX_GROUP_R Item number 30002
1-10	NUGRP	Number of transmitted power groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	FLUX_R (IGT)	Transmitted power (real part)

1-80	HEADER	Header FLUX_GROUP_I Item number 30003
1-10	NUGRP	Total number of transmitted power groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	FLUX_I (IGT)	Transmitted power (imaginary part)

J-8-12. Transmitted Current

(Step Data, Complex Numbers, and Scalar Values)

1-80	HEADER	Header CURRENT_GROUP_R Item number 30004
1-10	NUGRP	Total number of transmitted current groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	CURRENT_R (IGT)	Transmitted current (real part)
1-80	HEADER	Header CURRENT_GROUP_I Item number 30005
1-10	NUGRP	Number of transmitted current groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	CURRENT_I (IGT)	Transmitted current (imaginary part)

J-8-13. Voltage

(Step Data, Complex Numbers, and Scalar Values)

1-80	HEADER	Header VOLTEGE_GROUP_R
		Item number 30006
1-10	NUGRP	Total number of voltage groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	VOLTAGE_R (IGT)	Voltage (real part)
1-80	HEADER	Header VOLTAGE_GROUP_I
		Item number 30007
1-10	NUGRP	Number of voltage groups

* Repeat the following input sequence up to the number of groups.

1-10	IGT	Group ID
11-30	VOLTAGE_I (IGT)	Voltage (imaginary part)

J-8-14. Magnetic Flux Density

(Element Data, Complex Numbers, and Scalar Values)

1-80	HEADER	Header MAGNETIC_FLUX_DENSITY Item number 19501
1-10	NUMED	Number of elements which magnetic flux density is to be output

* Repeat the following input sequence up to the number of evaluation elements

1-10	I	Order ID
11-20	NE	Element ID
21-40	JX (I)	X-component of magnetic flux density (real part)
41-60	JY (I)	Y-component of magnetic flux density (real part)
61-80	JZ (I)	Z-component of magnetic flux density (real part)
81-100	JX (I)	X-component of magnetic flux density (imaginary part)
101-120	JY (I)	Y-component of magnetic flux density (imaginary part)
121-140	JZ (I)	Z-component of magnetic flux density (imaginary part)

J-8-15. Analysis Error

(Element Data, Real Values, and Scalar Values)

1-80	HEADER	ERROR_INDICATOR Item number 6503
1-10	NUMED	Number of elements which analysis error is to be output

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NE	Element ID
21-40	SE (1, NE)	Analysis error

J-8-16. Surface Current Density

(Element Data, Complex Numbers, and Vector Values)

1-80	HEADER	Header SURFACE_CURRENTS
		Item number 19510
1-10	NUM	Total number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NP (I)	Element ID
21-40	JX (I)	X-component of current density (real part)
41-60	JY (I)	Y-component of current density (real part)
61-80	JZ (I)	Z-component of current density (real part)
81-100	JX (I)	X-component of current density (imaginary part)
101-120	JY (I)	Y-component of current density (imaginary part)
121-140	JZ (I)	Z-component of current density (imaginary part)

J-8-17. Plasma Density

(Element Data, Real Values, and Scalar Values)

1-80	HEADER	Header PLASMA_DENSITY
		Item number 7601
1-10	NUM	Total number of evaluation elements

* Repeat the following input sequence up to the number of evaluation elements.

1-10	I	Order ID
11-20	NE	Element ID
21-40	PD(NE)	Plasma density

J-8-18. Quality Factor

(Step Data, Real Values, and Scalar Values)

1-80	HEADER	Header QUALITY_FACTOR Item number 30020
1-10	NPGRP	Total number of plasma calculation Region

* Repeat the following input sequence up to the number of groups.

1-10	IGL	Group ID
11-30	QF(IGL)	Quality factor

Appendix K. JCF File Format (Structural Analysis) for JMAG-Designer

This chapter describes various parameters that can be edited using a JCF file.

K-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

▶▶ Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:

- Target (Element ID, etc.)
- Type of item to be applied (Element face or nodal point, etc.)
- Contents of point sequence data used under conditions or material characteristics

K-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	common	Controls parameters related to the entire analysis.(P. 258)
condition_data	Control	Controls parameters for analysis control (study properties).(P. 259)
	Step	Controls parameters for frequency control.(P. 260)
	StructuralDamping	Controls parameters for modal damping for a study property.(P. 260)
	PressureLoad	Controls parameters for pressure load condition.(P. 261)
	VolumeLoad	Controls parameters for volume load condition.(P. 261)
	AccelerationLoad	Controls parameters for acceleration load condition.(P. 261)
	CentrifugalForce	Controls parameters for centrifugal force condition.(P. 262)
	ElectromagneticForce	Controls parameters for electromagnetic force condition.(P. 262)
	TemperatureLoad	Manages parameters for temperature load condition.(P. 262)
	PRESS	Controls parameters for press fit condition.(P. 263)
	DisplacementConstraint	Controls parameters for displacement condition.(P. 263)
	RigidBody	Controls parameters for rigid body condition.(P. 263)
	LockingConstraint	Controls parameters for constraint condition.(P. 264)
	CyclicBoundary	Controls parameters for periodic boundary condition.(P. 264)
	Adhesion	Controls parameters for adhesion condition.(P. 264)
	Spring	Controls parameters for spring condition.(P. 264)
	CONM2	Controls parameters for concentrated mass condition.(P. 265)

Block name		Description
	ACOUST	Controls parameters for sound pressure condition.(P. 265)
	PartProperty	Controls parameter for materials of each part.(P. 266)
material_data	MATERIAL	Controls parameters for material.(P. 267)

K-3. Basic Information of Analysis (control_parameters)

- **common**

The module 'common' is used to specify common items in all types of analysis in JMAG-Designer.

Item name	Parameter name	Type	Description
Analysis name	title	string	
JMAG version number	version	int	
Solver ID	solver_id	int	=31: 3D Static Analysis (DS)
			=32: 2D Static Analysis (DS)
			=34: 3D frequency analysis (DS)
			=35: 2D frequency analysis (DS)
			=41: 3D real eigen mode analysis (DS)
			=42: 2D real eigen mode analysis (DS)
Unit label	unit_label	string	

K-4. Setting Conditions (condition_data)

- **Control**

The Control block specifies each item for the study properties.

Item name	Parameter name	Type	Description
Analysis type	analysis_type	int	=0: Linear static analysis (101)
			=1: Real eigen mode analysis (103)
			=2: Frequency analysis (111)
Dimension of analysis model	flg_dimension	int	=0: 3D
			=1: 2D
Number of eigen values	number_of_eigen	int	
Flag for using second elements	flg_order	int	=1: Second element
			=0: First element
Convergence tolerance	subspace_tolerance	double	
Maximum number of iterations	subspace_max_iteration	int	
Refers to eigenmode analysis result	flg_restart	int	=0: Do not refer to eigenmode analysis result
			=1: Refer to eigenmode analysis
JPLOT file of eigenmode analysis that is referred	eigen_file	string	
Shift frequency	shift_frequency	double	
Calculation type	matrix_type	int	=0: Plane stress
			=1: Plane strain
Flag for output item: stress	flg_io_stress	int	=0: Do not export
			=1: Export
Flag for output item: strain	flg_io_strain	int	=0: Do not export
			=1: Export
Flag for output item: load	flg_io_force	int	=0: Do not export
			=1: Export
Flag for output item: velocity	flg_io_velocity	int	=0: Do not export
			=1: Export
Flag for output item: acceleration	flg_io_acceleration	int	=0: Do not export
			=1: Export
Flag for output item: eigen vector	flg_io_eigenventor	int	=0: Do not export
			=1: Export

- **Step**

The Step block specifies each item of step control.

Item name	Parameter name	Type	Description
Step type	step_type	int	=0: Interval
			=1: Regular intervals
			=2: Point sequence
Number of steps	num_analysis_step	int	
Interval	increment	double	Specify if step_type=0.
Initial value	start_value	double	Specify if step_type=1.
End value	end_value	double	Specify if step_type=1.
Number of divisions	step_division	int	Specify if step_type=1.

- **StructuralDamping**

Item name	Parameter name	Type	Description
	type	int	=0:
			=1:
	constant_damping	double	

- **ConcentratedLoad**

In ConcentratedLoad, the items of concentrated load conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Type	type	int	=0: Constant
			=1: Table
Load (amplitude) (N)	amplitude	double	Specify if type=0
Phase (deg)	phase	double	Specify if type=0
Load direction	direction vector	double	

- **PressureLoad**

PressureLoad block specifies each item for the pressure load condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Load (amplitude) [Pa]	amplitude	double	
Phase [deg]	phase	double	The phase can be set for a frequency analysis.
Load direction	flg_direction	int	= 1: Positive direction
			= -1: Negative direction

- **VolumeLoad**

The VolumeLoad block specifies each setting for the volume load condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Load [N]	amplitude	double	
Phase [deg]	phase	double	The phase can be set for a frequency analysis.
Load direction	direction_vector	double	

- **AccelerationLoad**

The AccelerationLoad block specifies each setting for the acceleration load condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Acceleration speed (m/sec2)	amplitude	double	
Load direction	direction_vector	double	

- **CentrifugalForce**

The CentrifugalForce block specifies each item for the centrifugal force condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Angular velocity	rps	double	
Axis direction	direction_vector	double	
Origin	origin	double	

- **ElectromagneticForce**

In ElectromagneticForce, the electromagnetic force conditions are specified.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Step type	step_type	int	=0: step =1: frequency
Magnetic field analysis model: Input file	solver_file	string	JCF file or solver data file *Absolute path
Magnetic field analysis model: PLOT file	plot_file	string	*Absolute path
Reference interval: starting step	start_step	int	If step_type=0
Reference interval: ending step	end_step	int	If step_type=0
Frequency	frequency	int	If step_type=1
FFT resolution	fft_resolution	int	
Coordinate ID	coordinate_id	int	

- **TemperatureLoad**

The TemperatureLoad block specifies each setting for the thermal load condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Type	type	int	=0: Constant =1: Temperature distribution =2: Temperature difference distribution

Item name	Parameter name	Type	Description
Thermal Analysis Result File	plot_file	string	* Specify the absolute path
Temperature (Celsius) or (Fahrenheit)	amplitude	double	If type=0
Step	step	int	If type=0 or 1
Start Step	start_step	int	If type=2

- **PRESS**

The PRESS block specifies each item for the press fit condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Clearance	clearance	double	

- **DisplacementConstraint**

The DisplacementConstraint block specifies each setting for the displacement condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Constraint direction type	direction_type	int	=0: Normal direction =1: Specified direction
Displacement	amplitude	double	Exported for static analysis and frequency analysis
Phase [deg]	phase	double	Exported for frequency analysis
Displacement direction	direction_vector	double	If direction_type=1

- **RigidBody**

The RigidBody block specifies each setting for the rigid body condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	

- **LockingConstraint**

The LockingConstraint block specifies each setting for the constraint condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Type of constraint direction	direction_type	int	=0: All
			=1: Normal direction
			=2: Tangent direction

- **CyclicBoundary**

In CyclicBoundary, the items of periodic boundary conditions are specified.

Item name	Parameter name	Type	Description
Conditional number	id	int	
Boundary type	cyclic_type	int	=+1: Rotation periodicity
A point on rotation axis	origin	double	* Specified for each component.
Direction of rotation axis	axis_vector	double	* Specified for each component.
Periodic angle or distance	angle	double	Periodic angle for rotational periodicity [deg]

- **Adhesion**

The Adhesion block specifies each setting for the adhesion condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Spring constant	spring_stiffness	double	

- **Spring**

The Spring block specifies each setting for the spring condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Spring constant	stiffness	double	

- **CONM2**

The CONM2 block specifies each setting for the concentrated mass condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Mass (kg)	mass	double	

- **ACOUST**

The ACOUST block specifies each setting for the sound pressure condition.

Item name	Parameter name	Type	Description
Condition ID	id	int	
Dimension	dim	int	
Evaluation plane type	type	int	=0: Circle (2D analysis) =1: Sphere (available in 3D analysis) =2: Cylinder (available in 3D analysis)
Radius of the evaluation plane (m)	r	double	Specify the radius regardless of the type
Number of divisions in the circumferential direction	division_theta	int	
Number of divisions in the axial or latitudinal direction	division_phi	int	
Flag for symmetry boundary	planeflg_sym	int	=0: None =1: Symmetry model

- **PartProperty**

The PartProperty block specifies each item for the part properties.

Item name	Parameter name	Type	Description
Material ID	material_id	int	
Type	type	int	=0: Solid
			=1: Shell
			=2: Beam
Cross-section type	cross_section_type	int	If type=2
			=0: Circle
			=1: Square
			=2: Rectangular
Radius	radius	double	if cross_section_type=0
Length of a square or a rectangular	edge_length1	double	If cross_section_type=1 or 2
Width	edge_length2	double	if cross_section_type=2
Thickness	thick	double	If type=1
Bending stiffness parameter	second_moment	double	If type=1
Ratio of transverse shear thickness to membrane	transverse_shear_thickness	double	If type=1
Distance from the neutral plane (top face)	fiber_zl	double	If type=1
Distance from the neutral plane (bottom face)	fiber_z2	double	If type=1

K-5. Setting Materials (material_data)

The items on the materials of magnetic field analysis are specified.

- **MATERIAL**

■ Isotropic material

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Type of material	mat_type	int	=1: Isotropic materials
Young's modulus [Pa]	young_modulus1	double	
Shear modulus [Pa]	shear_modulus1	double	
Poisson ratio	poissons_ratio1	double	
Mass density [kg/m^3]	mass_density	double	
Thermal Expansion coefficient [1/Celsius]	expansion_coef	double	
Reference Temperature [Celsius]	temperature	double	

■ Anisotropic material

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Type of material	mat_type	int	=2: 2Dimension anisotropic material
			=3: 2Dimension anisotropic material
Input type	set_input_type	int	=0: Input physical property (Young's modulus, Poisson's ratio)
			=1: Matrix input
Mass density [kg/ m^3]	modulus_mass_density	double	

Specify the following for physical property input

Young's modulus (X-direction) [Pa]	modulus_young_x_direction	double	* Can be specified only for set_input_type = 0.
Young's modulus (Y-direction) [Pa]	modulus_young_y_direction	double	* Can be specified only for set_input_type = 0.
Young's modulus (Z-direction) [Pa]	modulus_young_z_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (XY-direction) [Pa]	modulus_shead_elastic_xy_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (YZ-direction) [Pa]	modulus_shead_elastic_yz_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (ZX-direction) [Pa]	modulus_shead_elastic_zx_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (XY-direction)	modulus_poisson_xy_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (YZ-direction)	modulus_poisson_yz_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (ZX-direction)	modulus_poisson_zx_direction	double	* Can be specified only for set_input_type = 0.

Item name	Parameter name	Type	Description
Specify the following for physical property input or matrix input			
Thermal Expansion coefficient (X-direction) [1/Celsius]	heat_x_direction_temp	double	
Thermal Expansion coefficient (Y-direction) [1/Celsius]	heat_y_direction_temp	double	
Thermal Expansion coefficient (Z-direction)[1/Celsius]	heat_z_direction_temp	double	
Thermal Expansion coefficient (XY-direction) [1/Celsius]	heat_xy_direction_temp	double	
Thermal Expansion coefficient (YZ-direction) [1/Celsius]	heat_yz_direction_temp	double	
Thermal Expansion coefficient (ZX-direction) [1/Celsius]	heat_zx_direction_temp	double	
Reference Temperature [Celsius]	temperature	double	
Coordinate ID	set_cond_coordinate_id	int	

Appendix L. JCF File Format (Structural Analysis) for JMAG-Studio

This chapter describes various parameters that can be edited using a JCF file.

L-1. Overview

A JCF file can be modified without starting JMAG by using a file access library.

Reference

For more information about the editing tools, see P.1 "Chapter 15. Editing a JCF File (Simple FHI)".

Each parameter has a type when gaining access to a JCF file through a file access library. There are the following types.

- *string* means character line type
- *int* means integer type
- *double* means real number type
- *var* means variable type
- *complex* means complex number type
- *point* meams 3 component type configured from (x, y, z).

In gaining access to a JCF file, specify a parameter name in the function of a file access library and read or set the value.

The parameters of a JCF file are described on the next and later pages.

MEMO The items that cannot be edited in a JCF file are as follows:
-Target (Element ID, etc.)
-Type of item to be applied (Element face or nodal point, etc.)
-Contents of point sequence data used under conditions or material characteristics

L-2. Block List

This chapter describes the following blocks.

Block name		Description
control_parameters	common	Controls parameters related to the entire analysis.(P. 274)
condition_data	EXEC	Controls parameters for executive control condition.(P. 275)
	Case	Controls parameters for case control condition.(P. 276)
	SPC	Controls parameters for single point constraint condition.(P. 276)
	PSOLID	Controls parameters for solid element property condition.(P. 277)
	PSHELL	Controls parameter shell element property condition.(P. 277)
	EIGRL	Controls parameters for eigenvalue condition.(P. 277)
	FREQ1	Controls parameters for frequency list condition.(P. 278)
	TABDMP1	Controls parameters for modal damping table condition.(P. 278)
	TABLED1	Controls parameters for dynamic load table condition.(P. 278)
	JLOAD	Controls parameters for electromagnetic force condition.(P. 278)
	FORCE	Controls parameters for force condition.(P. 280)
	NEWCORD	Controls parameters for coordinate system condition.(P. 280)
	DLOAD	Controls parameters for dynamic load condition.(P. 281)
	PBAR	Controls parameters for beam element property condition.(P. 281)
	TEMP	Controls parameters for nodal temperature condition.(P. 282)
	RFORCE	Controls parameters for centrifugal force condition.(P. 282)
	GSPRING	Controls parameters for spring element condition.(P. 282)

Block name		Description
	ASPRING	Controls parameters for adhesion condition.(P. 282)
	CONM2	Controls parameters for concentrated mass condition.(P. 283)
	MPC	Controls parameters for multipoint constraint condition.(P. 283)
	RBE2	Controls parameters for rigid body element condition.(P. 284)
	ACOUST	Controls parameters for acoustic analysis condition.(P. 284)
	ELCRD	Controls parameters for electrode condition.(P. 284)
	PLOAD	Controls parameters for pressure load condition.(P. 285)
	DISPCORD	Controls parameters for displacement coordinate system condition.(P. 285)
	PRESS	Controls parameter for press fit condition.(P. 285)
	GRAV	Controls parameters for acceleration force condition.(P. 286)
	VOLUME_FORCE	Controls parameters for volume force condition.(P. 286)
	LINE_FORCE	Controls parameters for edge force condition.(P. 286)
material_data	MATERIAL	Controls parameters for material.(P. 287)

L-3. Basic Information of Analysis (control_parameters)

- **common**

In a common module, the item common to all analyses that are executed in JMAG is specified.

Item name	Parameter name	Type	Description
Analysis name	title	string	
Version No. of JMAG	version	int	
Solver ID	Solver_id	int	=15: Structural analysis
Unit label	unit_label	string	

L-4. Setting Conditions (condition_data)

- **EXEC**

In Exec, the items of executive control condition is specified.

Item name	Parameter name	Type	Description
Comment	id	string	
Solver type	sol	int	=101: Linear static analysis
			=103: Eigen value analysis
			=111: Frequency response analysis
Selection flag of analysis without constraint	flg_free	int	=1: Analysis without constraint
			=0: Analysis with constraint
Second order element usage flag	flg_order	int	=1: Second order element
			=0: First order element
Convergence tolerance	subtol	double	
Maximum number of iteration	subite	int	
Output flag of velocity	flg_velocity	int	=0: Not output.
			=1: Output.
Output flag of acceleration	flg_acceleration	int	=0: Not output.
			=1: Output.
Output flag of stress	flg_stress	int	=0: Not output.
			=1: Output.
Output flag of load	flg_force	int	=0: Not output.
			=1: Output.

- **Case**

In Case, the items of case control condition is specified.

Item name	Parameter name	Type	Description
Force set ID	load	int	
Dynamic load set ID	dload	int	
Frequency set ID	frequency	int	
Structural damping set ID	sdamping	int	
Single point constraint set ID	method	int	
Eigen value set ID	spc	int	
Temperature set ID	temperature	int	
Multiple constraint set ID	mpc	int	

- **SPC**

In SPC, the items of single point constraint conditions are specified.

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Component ID	coef	int	Combinations of the following numbers = 1: X component = 2: Y component = 3: Z component = 4: X component (rotation) = 5: Y component (rotation) = 6: Z component (rotation)
Displacement [m]	disp	double	
Phase [deg]	disp_phase	double	
Setting method of the displacement direction	type	int	=0: By coordinate system =1: By vector
Direction of displacement	direction	int	=0: All =1: Normal line =2: In-plane

- **PSOLID**

In PSOLID, the items of solid element property conditions are specified

Item name	Parameter name	Type	Description
Property ID	id	int	
Material ID	mid	int	

- **PSHELL**

In PSHELL, the items of shell element property conditions are specified

Item name	Parameter name	Type	Description
Property ID	id	int	
Material ID	mid1	int	
Thickness [m]	thick	double	
Material ID 2	mid2	int	Bending behavior (same as mid1)
Ratio of section secondary moment to bending	bending	double	
Material ID 3	mid3	int	Transverse shear behavior (same as mid1)
Ratio of transverse shear thickness	trans_shear	double	
Stress Computation (lower plane) [m]	fiber_z1	double	
Stress Computation (upper plane) [m]	fiber_z2	double	

- **EIGRL**

In EIGRL, the items of eigen value conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Number of eigen value	number_of_eigen	int	

- **FREQ1**

In FREQ1, the items of frequency list conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
First frequency [Hz]	first_frequency	double	
Increase of frequency [Hz]	frequency_increment	double	
Number of frequency increase	number_of_frequency_increment	int	

- **TABDMP1**

In TABDMP1, the items of modal damping table conditions are specified.

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	

- **TABLED1**

In TABLED1, the items of dynamic load table conditions are specified

Item name	Parameter name	Type	Description
Table ID	id	int	
Interpolation type (X-axis)	xaxis_type	int	=0: Linear =1: Logarithm
Interpolation type (Y-axis)	yaxis_type	int	=0: Linear =1: Logarithm

- **JLOAD**

In JLOAD, the electromagnetic force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Magnetic field analysis model: Input file	solver_file	string	JCF file or solver data file *Absolute path

Item name	Parameter name	Type	Description
Magnetic field analysis model: PLOT file	plot_file	string	*Absolute path
Reference interval: starting step	start_step	int	
Reference interval: ending step	end_step	int	
Full model extension	flg_full	int	=0: Not used
			=1: Used
FFT resolution	fft_resolution	int	
Scaling factor	scale	double	
Flag for use different mesh between magnetic field and structure	flg_map	int	=0: Not used
			=1: Used
Extension flag for 2D (magnetic field analysis) to 3D (structure analysis)	flg_extend	int	=0: Not used
			=1: Used
Extend distance [mm]	extend_distance	double	
Electromagnetic force table	group_type	group	group type: node
			ex.) Node1 freq1, fx(Re), fy(Re), fz(Re), fx(Im), fy(Im), fz(Im)
			ex.) Node1 freq2, fx(Re), fy(Re), fz(Re), fx(Im), fy(Im), fz(Im)
			ex.) Node1 freq2, fx(Re), fy(Re), fz(Re), fx(Im), fy(Im), fz(Im)
			ex.) Node2 freq1, fx(Re), fy(Re), fz(Re), fx(Im), fy(Im), fz(Im)
			ex.) Node2 freq2, fx(Re), fy(Re), fz(Re), fx(Im), fy(Im), fz(Im)
			* In the case of static analysis, the frequency is always zero.

- **FORCE**

In FORCE, the items of force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
1st component[N]	n1	double	
2nd component [N]	n2	double	
3rd component [N]	n3	double	
Scaling factor	scaling_factor	double	
Cylindrical coordinate system: coordinate system ID	cid	int	

- **NEWCORD**

In CORD, the items of coordinate system conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Coordinate type	cord	int	= 0: Rectangular coordinate system = 1: Cylindrical coordinate system
Origin: X-coordinate	x0	double	
Origin: Y-coordinate	y0	double	
Origin: Z-coordinate	z0	double	
A point on X axis: X-coordinate	x1	double	
A point on X axis: Y-coordinate	y1	double	
A point on X axis: Z-coordinate	z1	double	
A point on XZ plane: X-coordinate	x2	double	
A point on XZ plane: Y-coordinate	y2	double	
A point on XZ plane: Z-coordinate	z2	double	

- **DLOAD**

In DLOAD, the items of dynamic load conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Amplitude	amplitude	double	
Phase delay	delay	double	
Phase	phase	double	
Real table ID	tc	int	
Imaginary table ID	td	int	
Factor	c	int	= 1: X-component
			= 2: Y-component
			= 3: Z-component
			= 4: X-component (Rotation)
			= 5: Y-component (Rotation)
			= 6: Z-component (Rotation)

- **PBAR**

In PBAR, the items of beam element property conditions are specified

Item name	Parameter name	Type	Description
Property ID	id	int	
Material ID	mid	int	
Section area [m^2]	area	double	
Section secondary moment 1 [m^4]	i1	double	
Section secondary moment 2 [m^4]	i2	double	
Torsional constant [m^4]	j	double	

- **TEMP**

In TEMP, the items of nodal temperature conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Temperature [Celsius]	temperature	double	

- **RFORCE**

In RFORCE, the items of centrifugal force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Rotation speed [rps]	rps	double	

- **GSPRING**

In GSPRING, the items of spring element conditions are specified

Item name	Parameter name	Type	Description
Property ID	id	int	
Set ID	sid	int	
Spring constant [N/m]	stiffness	double	
Determination distance [m]	tolerance	double	
Flag to run pressure analysis	check_press	int	=0: Not used. =1: Used.

- **ASPRING**

In ASPRING, the items of adhesion conditions are specified

Item name	Parameter name	Type	Description
Property ID	id	int	
Spring constant [N/m]	stiffness	double	
Material ID (master)	master_mid	int	

Item name	Parameter name	Type	Description
Flag to include contact	check_contact	int	=0: Not used.
			=1: Used.

- **CONM2**

In CONM2, the items of concentrated mass conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Mass [kg]	mass	double	

- **MPC**

In MPC, the items of multipoint constraint conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Dependent node ID	g1	int	
Component of dependent node	c1	int	= 1: X component
			= 2: Y component
			= 3: Z component
			= 4: X component (rotation)
			= 5: Y component (rotation)
			= 6: Z component (rotation)
Coefficient of dependent node	a1	double	
Independent node ID	g2	int	
Components of independent node	c2	int	= 1: X component
			= 2: Y component
			= 3: Z component
			= 4: X component (rotation)
			= 5: Y component (rotation)
			= 6: Z component (rotation)
Coefficient of independent node	a2	double	
...			

- **RBE2**

In RBE2, the items of rigid body element conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
x component	tx	int	
y component	ty	int	
z component	tz	int	
x component (rotation)	rx	int	
y component (rotation)	ry	int	
z component (rotation)	rz	int	

- **ACOUST**

In ACOUST, the items of acoustic analysis conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Sound pressure evaluation point radius [m]	r	double	
Dimension	dim	int	
Symmetry model flag	flg_sym	int	=0: Not symmetry model
			=1: Symmetry model
Center point (X,Y,Z) [m]	origin	double	
Axis (X-direction, Y-direction, Z-direction)	axis_vector	double	

- **ELCRD**

In ELCRD, the items of electrode conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Flag for setting electric potential	flg_volt	int	=0: Do not set electric potential
			=1: Set electric potential

Item name	Parameter name	Type	Description
Electric potential [V]	volt_amplitude	double	
Phase [deg]	volt_phase	double	

- **PLOAD**

In PLOAD, the items of pressure load conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Pressure [Pa]	p	double	

- **DISPCORD**

In DISPCORD, the items of displacement coordinate system conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Coordinate system ID	cord	int	

- **PRESS**

In PRESS, the items of press fit conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Clearance flag	flg_clearance	int	=0: Do not set clearance =1: Set clearance
Clearance [m]	clearance	double	

- **GRAV**

In GRAV, the items of acceleration force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Set ID	sid	int	
Scaling factor	scale	double	
Acceleration vector (1st component)	n1	double	
Acceleration vector (2nd component)	n2	double	
Acceleration vector (3rd component)	n3	double	

- **VOLUME_FORCE**

In VOLUME _FORCE, the items of volume force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Volume force (1st component)	f1	double	
Volume force (2nd component)	f2	double	
Volume force (3rd component)	f3	double	

- **LINE_FORCE**

In LINE_FORCE, the items of edge force conditions are specified

Item name	Parameter name	Type	Description
ID	id	int	
Pressure [N/m]	pressure	double	

L-5. Setting Materials (material_data)

The items on the materials of magnetic field analysis are specified.

- **MATERIAL**

■ Isotropic materials

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Type of material	mat_type	int	=1: Isotropic materials
Young's modulus [Pa]	young_modulus1	double	
Shear modulus [Pa]	shear_modulus1	double	
Poisson ratio	poissons_ratio1	double	
Mass density [kg/m^3]	mass_density	double	
Thermal Expansion coefficient [1/Celsius]	expansion_coef	double	
Reference Temperature [Celsius]	temperature	double	

■ 2D anisotropy materials

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Type of material	mat_type	int	=2: 2D anisotropy materials
Specifying method of material properties	set_input_type	int	=0: Young's modulus, poisson ratio =1: Matrix input
Young's modulus (X-direction) [Pa]	modulus_young_x_direction	double	* Can be specified only for set_input_type = 0.

Item name	Parameter name	Type	Description
Young's modulus (Y-direction) [Pa]	modulus_young_y_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (XY-direction)	modulus_poisson_xy_direction	double	* Can be specified only for set_input_type = 0.
Mass density [kg/m^3]	modulus_mass_density	double	
Thermal Expansion coefficient (X-direction) [1/Celsius]	heat_x_direction_temp	double	
Thermal Expansion coefficient (Y-direction) [1/Celsius]	heat_y_direction_temp	double	
Thermal Expansion coefficient (XY-direction) [1/Celsius]	heat_xy_direction_temp	double	
Reference Temperature [Celsius]	temperature	double	
Coordinate ID	set_cond_coordinate_id	int	
Angle from X-axis [deg]	set_angle_from_x_axis	double	

■ 3D anisotropy materials

Item name	Parameter name	Type	Description
Material ID	material_id	int	* A positive number and sequence number are not necessarily required.
Type of material	mat_type	int	=3: 3D anisotropy materials
Specifying method of material properties	set_input_type	int	=0: Young's modulus, poisson ratio
			=1: Matrix input
Young's modulus (X-direction) [Pa]	modulus_young_x_direction	double	* Can be specified only for set_input_type = 0.

Item name	Parameter name	Type	Description
Young's modulus (Y-direction) [Pa]	modulus_young_y_direction	double	* Can be specified only for set_input_type = 0.
Young's modulus (Z-direction) [Pa]	modulus_young_z_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (XY-direction) [Pa]	modulus_shead_elastic_xy_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (YZ-direction) [Pa]	modulus_shead_elastic_yz_direction	double	* Can be specified only for set_input_type = 0.
Shear modulus (ZX-direction) [Pa]	modulus_shead_elastic_zx_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (XY-direction)	modulus_poisson_xy_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (YZ-direction)	modulus_poisson_yz_direction	double	* Can be specified only for set_input_type = 0.
Poisson ratio (ZX-direction)	modulus_poisson_zx_direction	double	* Can be specified only for set_input_type = 0.
Mass density [kg/m^3]	modulus_mass_density	double	
Thermal Expansion coefficient (X-direction) [1/Celsius]	heat_x_direction_temp	double	
Thermal Expansion coefficient (Y-direction) [1/Celsius]	heat_y_direction_temp	double	
Thermal Expansion coefficient (Z-direction)[1/Celsius]	heat_z_direction_temp	double	
Thermal Expansion coefficient (XY-direction) [1/Celsius]	heat_xy_direction_temp	double	

Item name	Parameter name	Type	Description
Thermal Expansion coefficient (YZ-direction) [1/Celsius]	heat_yz_direction_temp	double	
Thermal Expansion coefficient (ZX-direction) [1/Celsius]	heat_zx_direction_temp	double	
Reference Temperature [Celsius]	temperature	double	
Coordinate ID	set_cond_coordinate_id	int	

Appendix M. Solver Data File Format (Structural Analysis)

M-1. Input Data Creation

Input data practically complies with the format defined by MSC/NASTRAN. They are divided into the following three blocks.

■ Executive control card

These card data are used to select the analysis type. The card named CEND indicates the end of this block.

■ Case control card

These card data are used to select data for performing the analysis from among those defined in the "(3) Bulk card", such as forces and restriction conditions.

■ Bulk card

These card data are used to define the geometrical information, forces, and boundary conditions.

This block starts with the BEGIN BULK card and ends with the ENDDATA card.

Input data can be generated using JVISION, and it is not necessary to identify whether the data belongs to the case control card or the bulk card.

Moreover, since the following data are not supported at present, they must be input manually.

■ Case control card

FREQUENCY=n
SDAMPING=n
METHOD=n

■ Bulk card

TABDMP1

EIGRL

FREQ

The following are input specifications for each block.

M-2. Executive Control Card

These card data are used to determine analysis type. Input in free format.

M-2-1. Input Specification

■ **SOL n**

*mandatory

Purpose: Select the solver type

n:	101	Static analysis
	103	Modal response analysis
	111	Modal frequency response analysis

■ **$subite**

Purpose: Specify maximum iterations for eigen value analysis.

■ **$subtol**

Purpose: Specify convergence tolerance for eigen value analysis.

■ **$iver**

The version information

■ **$eigmeth**

Purpose: Specify the eigen value analysis without constraint

0: Do not run eigen value analysis without constraint

1: Run eigen value analysis without constraint

■ **$order**

Purpose: Specify the use of second order element

0: Do not use second order element

1: Use second order element

M-3. Case Control Card

The data of this card block are used to select data for performing analysis from among those defined in the "(3) Bulk card", such as forces and restriction conditions. Unless data are selected in this card, the data defined in the bulk card cannot be used for analysis.

Input all the data in free format.

M-3-1. Input Specification

■ LOAD=n *mandatory for linear static analysis

Purpose: Selects force.

n: ID of force specified by the FORCE or RFORCE bulk card

■ DLOAD=n

Purpose: Selects dynamic load.

n: ID of load specified by the DLOAD bulk card

■ FREQUENCY=n *mandatory for modal frequency response analysis

Purpose: Selects the frequency calculation tables.

n: ID of frequency table specified by the FREQ bulk card

■ SDAMPING=n *mandatory for modal frequency response analysis

Purpose: Selects modal damping.

n: ID of modal damping table specified by the TABDMP1 bulk card

■ METHOD=n *mandatory for modal frequency response analysis

Purpose: Selects the number of eigen values required for analysis.

n: ID specified by the EIGRL bulk card

■ SPC=n *mandatory when using single point constraint conditions

Purpose: Selects single point constraint.

n: ID of single point constraint specified by the SPC bulk card

- **MPC=n *mandatory when using multipoint constraint conditions**

  Purpose: Selects multipoint constraint

  n: ID of multipoint constraint specified by the MPC bulk card

- **velo=all or none**

  Purpose: Controls output for velocity.

  all: Outputs velocity, none = Not outputs velocity

- **acce=all or none**

  Purpose: Controls output for acceleration.

  all: Outputs acceleration, none = Not outputs acceleration

- **stre=all or none**

  Purpose: Controls output for stress.

  all: Outputs stress, none = Not outputs stress

- **force=all or none**

  Purpose: Controls output for input load.

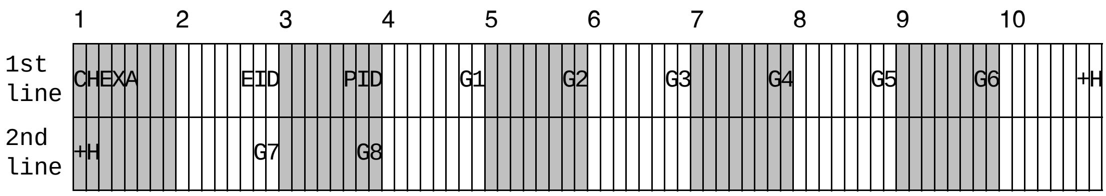
  all: Outputs input load, none = Not outputs input load

M-4. Bulk Card

There is a bulk card for which a small field format or large field format is used.

■ Small field format

For a small field format, one card comprises ten fields with one field consisting of eight columns.



Small field format Sample

The first field is used to identify data. For example, data becomes CHEXA for a hexahedron solid element.

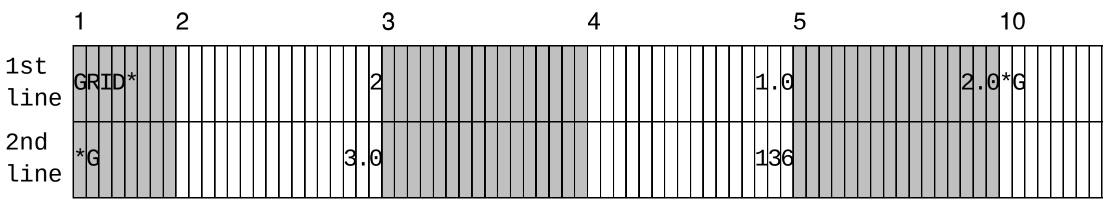
The second to ninth fields are used for input data.

The tenth field is used to identify a continuation card. For the tenth field in the first line or later and the first field in the second line or later, enter "+" in the first column and enter an arbitrary character string in the second to eighth columns when you require a continuation line.

The card in which the first column in the first field begins with "$" is considered a comment line.

■ Large field format

For a large field format, one card comprises two fields with one field consisting of eight columns and four fields with one field consisting of 16 columns.



Large field format Sample

The first field is used to identify data. For example, data becomes GRID for a nodal point.

The second to fifth fields are used for input data.

The sixth field is used to identify a continuation card. For the sixth field in the first line or later and the first field in the second line or later, enter "*" in the first column and enter an arbitrary character string in the second to eighth columns when you require a continuation line.

The card in which the first column in the first field begins with “$” is considered a comment line.

The type of the format corresponding to the first field-data identification item is described below.

Data identification item	Description	Format
ASPRING	Defines the bonding conditions.	S
CBAR	Defines the beam elements	S
CHEXA	Defines the hexahedron solid elements	S
CONM2	Specifies the concentrated mass.	S
CORD2C	Defines the cylindrical coordinate system.	S
CORD2R	Defines the rectangular coordinate system.	S
CPENTA	Defines the pentahedron solid elements	S
CQUAD4	Defines the quadrilateral shell elements	S
CTETRA	Defines the tetrahedron solids elements	S
CTRIA3	Defines the triangular shell elements	S
DAREA	Defines the degree of freedom and scale factor of the dynamic load	S / L
DLOAD	Select the dynamic load.	S
EIGRL	Defines the number of eigen values required for analysis	S
ELCRD	Defines the electrode	S
FORCE	Defines nodal lumped static force	S / L
FREQ1	Defines the frequency calculation	S
GRAV	Defines the acceleration force	S / L
GRID	Defines the node	S / L
GSPRING	Defines the spring elements.	S
JMAT2	Defines 2D anisotropic material properties (Young's modulus, Poisson ratio format)	S
JMAT9	Defines 3D anisotropic material properties (Young's modulus, Poisson ratio format)	S
MAT1	Defines the isotropic material properties.	S / L
MAT2	Defines 2D anisotropic material properties (Matrix format)	S

Data identification item	Description	Format
MAT9	Defines 3D anisotropic material properties (Matrix format)	S
MATE	Defines the relative permittivity	S
MATP	Defines the piezoelectric constant	S
MPC	Specifies the multipoint constraint	S
PBAR	Defines shape properties of the beam element	S
PLOAD	Defines the pressure load	S
PSHELL	Defines shape properties of the shell element	S
PSOLID	Defines shape properties of the solid element	S
RBE2	Defines the rigid body elements	S
RFORCE	Defines the centrifugal force	S
RLOAD1	Defines the dynamic load (Type 1)	S / L
RLOAD2	Defines the dynamic load (Type 2).	S / L
SPC	Defines the single point constraint	S
TABDMP1	Defines the modal damping in table form	S
TABLED1	Defines the function in table form.	S / L
TEMP	Defines the nodal temperature.	S / L

In the following, the specification for each input data is described. The number shown in the round brackets () indicates the field number.

M-4-1. Input Specification

■ ASPRING

Purpose: Defines the bonding conditions.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ASPRING	SID	NUM	K	ICON-TACT	MATID				+
+	N1	N2	N3	•••					

SID Property ID
NUM Number of nodes
K Spring constant
ICONTACT Simple contact analysis flag
MATID Master side material ID
N1, N2 Node ID

■ CBAR

Purpose: Defines the beam element.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CBAR	EID	PID	G1	G2	X1	X2	X3		

EID Element ID (integer > 0)
PID Shape property ID (integer > 0; PBAR card reference number)
G1, G2 Node ID consist of an element (integer > 0)
X1, X2, X3 Coordinates of the vector to define the Y-axis of the element coordinate system (real number)

- Set element ID in such a way as to avoid duplicating.
- Prevent the vector directed from G1 to G2 and the vector (X1, X2, X3) from being parallel to each other.

■ CHEXA

Purpose: Defines the hexahedron solid elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CHEXA	EID	PID	G1	G2	G3	G4	G5	G6	+CHEXA01
+CHEXA01	G7	G8							

EID	Element ID (integer > 0)
PID	Shape property ID (integer > 0, the PSOLID card reference number)
G1-G8	Node ID consist of an element (integer > 0)

- Set element ID in such a way as to avoid duplicating.
- Setting continued cards is mandatory.

■ CONM2

Purpose: Specifies the concentrated mass.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CONM2	EID	G		M					

EID	Element ID
G	Node ID
M	Mass

■ CORD2C

Purpose: Defines the cylindrical coordinate system.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CORD2C	CID	0	A1	A2	A3	B1	B2	B3	+
+	C1	C2	C3						

CID	Coordinate system ID
A1	Origin: X-coordinate
A2	Origin: Y-coordinate
A3	Origin: Z-coordinate
B1	A point on Z-axis: X-coordinate
B2	A point on Z-axis: Y-coordinate
B3	A point on Z-axis: Z-coordinate
C1	A point on an XZ-plane: X-coordinate
C2	A point on an XZ-plane: Y-coordinate
C3	A point on an XZ-plane: Z-coordinate

■ CORD2R

Purpose: Defines the rectangular coordinate system.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CORD2R	CID	0	A1	A2	A3	B1	B2	B3	+
+	C1	C2	C3						

CID Coordinate system ID
A1 Origin: X-coordinate
A2 Origin: Y-coordinate
A3 Origin: Z-coordinate
B1 A point on Z-axis: X-coordinate
B2 A point on Z-axis: Y-coordinate
B3 A point on Z-axis: Z-coordinate
C1 A point on an XZ-plane: X-coordinate
C2 A point on an XZ-plane: Y-coordinate
C3 A point on an XZ-plane: Z-coordinate

■ CPENTA

Purpose: Defines the pentahedron solid elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CPENTA	EID	PID	G1	G2	G3	G4	G5	G6	

EID Element ID (integer > 0)
PID Shape property ID (integer > 0, the PSOLID card reference number)
G1-G6 Node ID consist of an element (integer > 0)

- Set element ID in such a way as to avoid duplicating.

■ CQUAD4

Purpose: Defines the quadrilateral shell elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CQUAD 4	EID	PID	G1	G2	G3	G4			

EID Element ID (integer > 0)
PID Shape property ID (integer > 0, PSHELL card reference)
G1, G2, G3, G4 Node ID assigned within an element (integer > 0)

- Set element ID in such a way as to avoid duplicating.
- Make all interior angles less than 180 degrees.

■ CTETRA

Purpose: Defines the tetrahedron solid elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CTETRA	EID	PID	G1	G2	G3	G4			

EID	Element ID (integer > 0)
PID	Shape property ID (integer > 0; PSOLID card reference number)
G1, G2, G3, G4	Node ID consist of an element (integer > 0)

- Set element ID in such a way as to avoid duplicating.

■ CTRIA3

Purpose: Defines the triangular elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CTRIA3	EID	PID	G1	G2	G3				

EID	Element ID (integer > 0)
PID	Shape property ID (integer > 0; PSHELL card reference number)
G1, G2, G3	Node ID consist of an element (integer > 0)

- Set element ID in such a way as to avoid duplicating.

■ DAREA

*mandatory for modal frequency response analysis

Purpose: Defines the degree of freedom and scale factor of the dynamic load.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DAREA	SID	P1	C1	A1	P2	C2	A2		

SID	Order ID (integer > 0; referred from the RLOAD1 and RLOAD2 bulk card)
Pi	Node ID (integer > 0)
Ci	Degree of freedom number (either one of number 1 to 6)
Ai	Scale factor of the dynamic load (real number) i=1,2

- The degree of freedom number can be defined up to two per one card.
- Input the number of the degree of freedom to the global coordinates system.

■ DLOAD

Purpose: Select dynamic load.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DLOAD	SID	S	Si	Li	•••				

SID	Dynamic load ID
S	Scale factor
Si	Scale factor
Li	Dynamic load ID of RLOAD1
	The item below is repeated as many times as the number of RLOAD1.

- DLOAD is repeated proportionally to the number of RLOAD1s.
- “DLOAD” is output to conform to the Nastran format.
  In JMAG-Studio, “DLOAD” is not read. Therefore, S and Si are forcibly set to “1.0”.

■ EIGRL

*mandatory for modal frequency response analysis

Purpose: Defines the number of eigen values required for analysis.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EIGRL	SID			ND					

SID	Order ID (integer > 0; referred from the METHOD case control card)
ND	Number of eigen values required for analysis (integer > 0)

- Unless SID is referred from the METHOD = SID case control card, this data cannot be used.
- If this card is not included, the number of eigen values is set to 1.

■ ELCRD

Purpose: Defines the electrode.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ELCRD	SID	numOf-nodes	IVOLT	Vamp	Vphase				+
+	N1	N2	N3	•••					

SID	Order ID
numOfnodes	Number of nodes
IVOLT	Flag of electric potential
Vamp	Amplitude [V]
Vphase	Phase [deg]
Nj	Node number

■ FORCE

*used for static analysis

Purpose: Defines nodal lumped static force.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FORCE	SID	G		F	N1	N2	N3		

SID	Order ID (integer > 0; referred from the LOAD case control card.)
G	Node number (integer > 0)
F	Scale factor for force (real number)
N1, N2, N3	Force vector component

- Force vector for node G is given by F * (N1, N2, N3).
- Input the values of force vector components expressed in the global coordinate system.
- Unless SID is referred from the LOAD = SID case control card, this data cannot be used.

■ FREQ1

*mandatory for modal frequency response analysis

Purpose: Defines the frequency calculation.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FREQ 1	SID	F1	DF	NDF					

SID	ID of frequency table (integer > 0; referred from of the FREQUENCY case control card)
F1	Initial value (real number 0.0)
DF	Increment value (real number > 0.0)
NDF	Number of increments (integer > 0)

With the above input data, frequency calculation can be expressed by the following equation.

$fi = F1 + DF * (i\text{-}1)$

$(I = 1, 2\ldots.., NDF+1)$

- Unit of F1 and DF is Hz.
- Unless SID is referred from the FREQ = SID case control card, this data cannot be used.

■ GRAV

Purpose: Defines the acceleration force.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GRAV	SID	0	SCAL E	N1	N2	N3			

SID	ID of acceleration force (integer > 0; referred from of the Load case control card)
SCALE	Scale factor (real number)
N1	X component of acceleration vector
N2	Y component of acceleration vector
N3	Z component of acceleration vector

- Acceleration vector is given by SCALE * (N1, N2, N3).
- Unit of N1, N2, N3 is m/s^2.
- Unless SID is referred from the LOAD = SID case control card, this data cannot be used.

■ GRID

*mandatory

Purpose: Defines the node.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GRID	ID		X1	X2	X3		PS		

ID	Node number (integer > 0)
X1, X2, X3	Coordinates (real number)
PS	Node restriction conditions (Leave blank or set a number from 1 to 6.) 1: X-direction restriction 2: Y-direction restriction 3: Z-direction restriction 4: X-axis rotation restriction 5: Y-axis rotation restriction 6: Z-axis rotation restriction

- Defines node coordinates in the global system.
- Node restrictions are conducted.

■ GSPRING

Purpose: Defines the spring elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GSPRING	SID	NUM	K	TOL	IPRESS				+
+	N1	N2	N3	•••					

SID	Property number
NUM	Number of nodes
K	Spring constant
TOL	Determination distance
IPRESS	Pressure fit analysis flag
N1, N2	Node number

■ JMAT2

(Young's modulus, Poisson ratio format)

Purpose: Defines 2D anisotropic material properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
JMAT2	MID	EX	EY	GXY	NUXY	RHO	A1	A2	+
+	A3	TREF	MCSID						

MID	Material property ID
EX	Young's modulus (X-direction)
EY	Young's modulus (Y-direction)
GXY	Shear elastic coefficient (XY-direction)
NUXY	Poisson's ratio (XY-direction)
RHO	Mass density
A1	Heat expansion coefficient (X-direction)
A2	Heat expansion coefficient (Y-direction)
A3	Heat expansion coefficient (XY-direction)
TREF	Reference temperature
MCSID	Coordinate system number

■ JMAT9

(Young's modulus, Poisson ratio format)

Purpose: Defines 3D anisotropic material properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
JMAT 9	MID	EX	EY	EZ	GXY	GYZ	GZX	NUXY	+
+	NUYZ	NUZX	RHO	A1	A2	A3	A4	A5	+
+	A6	TREF							

MID	Material property ID
EX	Young's modulus (X-direction)
EY	Young's modulus (Y-direction)
EZ	Young's modulus (Z-direction)
GXY	Shear elastic coefficient (XY-direction)
GYZ	Shear elastic coefficient (XZ-direction)
GZX	Shear elastic coefficient (ZX-direction)
NUXY	Poisson's ratio (XY-direction)
NUYZ	Poisson's ratio (XY-direction)
NUZX	Poisson's ratio (XY-direction)
RHO	Mass density
A1	Heat expansion coefficient (X-direction)
A2	Heat expansion coefficient (Y-direction)
A3	Heat expansion coefficient (Z-direction)
A4	Heat expansion coefficient (XY-direction)
A5	Heat expansion coefficient (YZ-direction)
A6	Heat expansion coefficient (ZX-direction)
TREF	Reference temperature

■ MAT1

*mandatory

Purpose: Defines the material properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MAT1	MID	E	G	NU	RHO	A	TREF		

MID	Material property ID (integer > 0; referred from the PBAR, PSHELL and PSOLID card.)
E	Young's modulus (real number > 0.0)
G	Shear modulus (real number > 0.0)
NU	Poisson ratio (real number > 0.0)
RHO	Mass density (real number > 0.0, mandatory for modal frequency response analysis)
A	Thermal expansion coefficient
TREF	Reference temperature

- Set material property ID in such a way as to avoid duplicating.
- Element mass is automatically calculated from mass density and element volume.
- If either E, G, or NU is blank, the value of the blank column is calculated from the equation, E = 2(1 + NU) G.

■ MAT2

(Matrix format)

Purpose: Defines 2D anisotropic material properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MAT2	MID	G11	G12	G13	G22	G23	G33	RHO	+
+	A1	A2	A3	TREF					+
+	MCSID								

MID	Material property ID
Gij	Material properties matrix
RHO	Mass density
A1	Heat expansion coefficient (X-direction)
A2	Heat expansion coefficient (Y-direction)
A3	Heat expansion coefficient (XY-direction)
TREF	Reference temperature
MCSID	Coordinate system number

■ MAT9

(Matrix format)

Purpose: Defines 3D anisotropic material properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MAT9	MID	G11	G12	G13	G14	G15	G16	G22	+
+	G23	G24	G25	G26	G33	G34	G35	G36	+
+	G44	G45	G46	G55	G56	G66	RHO	A1	+
+	A2	A3	A4	A5	A6	TREF			

MID	Material property ID
Gij	Material properties matrix
RHO	Mass density
A1	Heat expansion coefficient (X-direction)
A2	Heat expansion coefficient (Y-direction)
A3	Heat expansion coefficient (Z-direction)
A4	Heat expansion coefficient (XY-direction)
A5	Heat expansion coefficient (YZ-direction)
A6	Heat expansion coefficient (ZX-direction)
TREF	Reference temperature

■ MATE

Purpose: Defines the dielectric constant.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MATE	MID	E11	E22	E33					

MID	Material property ID
Eij	Relative dielectric matrix component

■ MATP

Purpose: Defines the piezoelectric stress.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MATP	MID	E11	E12	E13	E21	E22	E23	E31	+
+	E32	E33	E41	E42	E43	E51	E52	E53	+
+	E61	E62	E63						

MID	Material property ID
Eij	Piezoelectric matrix component

■ MPC

Purpose: Specifies the multipoint constraint.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MPC	SID	G1	C1	A1	G2	C2	A2		+
+		G3	C3	A3	•••				+
+									

SID	Property ID
Gj	Node number
Cj	Component number
Aj	Coefficient

■ PBAR

*mandatory when using beam element

Purpose: Defines the beam element properties.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PBAR	PID	MID	A	I1	I2	J			

PID	Shape property ID (integer > 0; referred from the CBAR card)
MID	Material property ID (integer > 0; MAT1 card reference number)
A	Section area (real number > 0.0)
I1	Inertia moment about the Z-axis in the element coordinate system (real number > 0.0)
I2	Inertia moment about the Y-axis in the element coordinate system (real number > 0.0)
J	Torsional constant (real number)

- Set the PBAR property number in such a way as to avoid duplicating.

■ PLOAD

Purpose: Defines the pressure load.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PLOA D	SID	P							

SID	ID
numOfnodes	Pressure load [Pa]

■ PSHELL

*mandatory when using shell element

Purpose: Defines shape property of the shell element.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PSHELL	PID	MID	T		12I/T**3		TS/T		
	Z1	Z2							

PID	Shape property ID (integer > 0; referred from the CTRIA3 and CQUAD4 card)
MID	Material property ID (integer > 0; MAT1 card reference number)
T	Board thickness (real number > 0.0)
	Ratio of sectional second moment to bending stiffness parameter (real number > 0.0)
TS/T	Ratio of transverse shear thickness to membrane (real number > 0.0)
Z1, Z2	Stress computation

- Set the PSHELL property number in such a way as to avoid duplicating.

■ PSOLID

*mandatory when using solid element

Purpose: Defines shape property of the solid element.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PSOLID	PID	MID							

PID	Shape property ID (integer > 0; referred from the CTETRA, CPENTA, and CHEXA card)
MID	Material property ID (integer > 0; MAT1 card reference number)

- Set the PSOLID property number in such a way as to avoid duplicating.

■ RBE2

Purpose: Defines the rigid body elements.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RBE2	EID	GN	CM	GM1	GM2	GM3	GM4	GM5	+
+	GM6	•••							

EID	Element ID
GN	Independent node ID
CM	Dependent degree of freedom
GM1, GM2	Dependent node ID

■ RFORCE

*used for static analysis

Purpose: Defines the centrifugal force.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RFORCE	SID	G	CID	A	R1	R2	R3		

SID	Identifier (integer > 0; referred from the LOAD case control card.)
G	Node number (integer > 0)
CID	Coordinate system to define rotation vector components (integer 0)
A	Scale factor for angular velocity due to the effect of the number of rotations per unit of time
R1, R2, R3	Components of rotation vector

- Components of rotation vector (R1, R2 and R3) is the Z-axis (0.0, 0.0, 1.0).
- Unless SID is referred from the LDAD = SID case control card, this data cannot be used.

■ RLOAD1

*mandatory for modal frequency response analysis

Purpose: Defines the dynamic load (Type 1).

P (f)=A[C (f)+jD (f)]

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RLOAD1	SID	DAREA			TC	TD			

SID	ID (integer > 0; referred from the DLOAD case control card)
DAREA	ID of DAREA (integer > 0; used for referring the DAREA card A-definition)
TC	Real part function number (integer ≥ 0; used for referring the TABLED1 card)
TD	Imaginary part function number (integer ≥ 0; used for referring the TABLED1 card)

- Unless SID is referred from the DLOAD = SID case control card, this data cannot be used.
- Set the RLOAD1 and RLOAD2 property numbers in such a way as to avoid duplicating.

■ RLOAD2

*mandatory for modal frequency response analysis

Purpose: Defines the dynamic load (Type 2).

P (f)=AB (f) exp {j ϕ(f)}

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
RLOAD2	SID	DAREA			TB	TP			

SID	Identifier (integer > 0; referred from the DLOAD case control card)
DAREA	Identifier (integer > 0; used for referring the DAREA card A-definition)
TB	Function number to determine B (f) (integer >=0; used for referring the TABLED1 card)
TP	Function number to determine ϕ (f) (integer >=0; used for referring the TABLED1 card)

- Unless SID is referred from the DLOAD = SID case control card, this data cannot be used.
- Set the RLOAD1 and RLOAD2 property numbers in such a way as to avoid duplicating.

■ SPC

Purpose: Defines the single point constraint.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SPC	SID	G1	C1	D1					

SID	Identifier (integer > 0; referred from the SPC case control card)
Gi	Node number (integer > 0)
Ci	Component ID (either one of the following 1 to 6) 1: X-axis direction translation 2: Y-axis direction translation 3: Z-axis direction translation 4: X-axis rotation 5: Y-axis rotation 6: Z-axis rotation
Di	Single point constraint value (real number)

- Unless SID is referred from the SPC = SID case control card, this data cannot be used.
- It can be specified in combination with the PS in the GRID.

■ TABDMP1

*mandatory for modal frequency response analysis

Purpose: Defines the modal damping table in table form.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TABDMP1	TID								+TABD001
+TABD001	F1	G1	F2	G2	F3	G3	F4	G4	+TABD002
+TABD002	F5	G5	END T						

TID	Function number (integer > 0; referred from the SDAMPING bulk card)
Fi	Frequency (real number)
Gi	Damping value (real number)

- Unless TID is referred from the SDAMPING = TID case control card, this data cannot be used.
- Set a series of Fis, in either ascending or descending order, in such a way that all Fis are different from each other.
- Display the end of data by inputting 'ENDT' into the next field of the last data.
- If a frequency value input is inside the interval of data set in the table, which consists of N points such as (F1, F2,..., FN), the damping value is calculated by interpolating two values of the nearest points of the data set in the table. Conversely, if the value input is outside of the interval, it is calculated by extrapolating two values of F1 and F2, or those of FN-1 and FN

■ TABLED1

*mandatory for modal frequency response analysis

Purpose: Defines the function in table form.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TABLED1	TID								+TABL001
+TABL001	X1	Y1	X2	Y2	X3	Y3	X4	Y4	+TABL002
+TABL002	X5	Y5	END T						

TID	Function number (integer > 0; referred from the RLOAD1 bulk card)
Xi,Yi	Function values of transverse axis and longitudinal axis (real number)

- The unit of Xi is Hz.
- Set a series of Xis, in either ascending or descending order, in such a way that all Xis are different from each other.
- Display the end of data by inputting `ENDT' into the next field of the last data.
- If a frequency value input is inside the interval of data set in the table, which consists of N points such as (X1, X2,..., XN), the damping value is calculated by interpolating two values of the nearest points of the data set in the table. Conversely, if the value input is outside of the interval, it is calculated by extrapolating two values of X1 and X2, or those of XN-1 and XN.

■ TEMP

Purpose: Defines the nodal temperature.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TEMP	SID	G1	T1						

SID	Property number
T1	Temperature

Appendix N. PLOT File Format (Structural Analysis)

N-1. Analysis Control

Card 1

1-80	HED	Title

Card 2

1-5	Unused	
6-10	Unused	
11-15	Unused	
16-20	Unused	
21-25	Unused	
26-30	Unused	
31-35	Unused	
36-40	Unused	
41-45	Unused	
46-50	Unused	
51-55	Unused	
56-60	Unused	
61-65	Unused	
66-70	Unused	
71-75	ID_SLV	Solver ID =31: 3D static analysis (JMAG-Designer) =32: 2D static analysis (JMAG-Designer) =34: 3D frequency response analysis (JMAG-Designer) =35: 2D frequency response analysis (JMAG-Designer) =41: 3D eigenmode analysis (JMAG-Designer) =42: 3D eigenmode analysis (JMAG-Designer) =101: Static analysis (JMAG-Studio)

		=103: Eigen value analysis (JMAG-Studio)
		=111: Frequency response analysis (JMAG-Studio)
75-80	IVER	Version number (= 50)

Card 3

1-20	UNITOT	Unit for the result display
21-40	UNITIN	Unit for the geometry data
41-80	UNITNM	Unit label

Card 4

1-5	ITRAN	Analysis type
6-10	NSTEP	Number of analysis steps
11-15	Unused	
16-20	Unused	
21-30	Unused	
31-35	Unused	
36-40	Unused	
41-45	Unused	
46-50	Unused	
51-55	Unused	
56-65	Unused	
66-75	Unused	
76-80	Unused	

N-2. Control Output Items

Card 1

1-10	N_CNT2	Number of lines in the control card 2

Card 2

1-10	Unused
11-20	Unused
21-30	Unused

Card 3

1-20	Unused
21-30	Unused

Card 4

1-5	Unused	
6-10	Unused	

N-3. Control Variables for Mesh Generator

Card 1

1-10	NLINE	Number of lines

Card 2

1-10	Unused	
11-20	Unused	
21-30	Unused	
31-40	Unused	

N-4. Step Control

Card 1

1-10	Unused	
11-20	Unused	

Card 2

1-10	Unused	
11-20	Unused	

N-5. Control Output Interval

Card 1

1-10	N_OUT	Number of output interval control data of analysis results

Card 2

1-10	N	Order number
11-20	N_END (N)	Output interval control end step
21-30	N_STP (N)	Output interval up to the time N

N-6. Coordinate Data

Card 1

1-10	NUMNP	Total nodes
11-20	Unused	
21-31	Unused	
32-80	Unused	

Card 2

1-10	ID	Order number
11-20	ID	Node ID
21-40	X	X-coordinate
41-60	Y	Y-coordinate
61-80	Z	Z-coordinate

N-7. Element Data

Card 1

1-8	NUMEL	Total elements
9-10	Unused	
11-15	Unused	
16-80	Unused	

Card 2

1-8	M	Element ID
9-11	IEL (M)	Total nodes
12-14	MTYP (M)	Material ID
15-16	ETYP (M)	Element type =1: Solid hexahedron element (first coordinate) =3: Solid tetrahedron element (first coordinate) =5: Solid pentahedron element (first coordinate) =7: Shell element (first coordinate) =9: Beam element (first coordinate) =11: Shell triangle element (first coordinate)
17-24	NOD (1,IEL)	Node ID (1)
25-32	NOD (2,IEL)	Node ID (2)
33-40	NOD (3,IEL)	Node ID (3)
41-48	NOD (4,IEL)	Node ID (4)
49-56	NOD (5,IEL)	Node ID (5)
57-64	NOD (6,IEL)	Node ID (6)
65-72	NOD (7,IEL)	Node ID (7)
73-80	NOD (8,IEL)	Node ID (8)

N-8. Analysis Results

N-8-1. Control Data (DS-ST)

1-80	CONTROL_DATA	Header
1-10	ISTEP	Analysis step number
11-30	TIME	Time

N-8-2. Control Data (DS-EIG)

1-80	CONTROL_DATA	Header
1-10	ISTEP	Analysis step number
11-30	EIGEN	Eigen frequency

N-8-3. Control Data (DS-FQ)

1-80	CONTROL_DATA	Header
1-10	ISTEP	Analysis step number
11-30	FREQ	Frequency

N-8-4. Displacement (Node Data) (DS-ST and DS-EIG)

1-80	DISPLACEMENT	Header
1-10	MAXING	Number of nodes with a value assigned to displacement

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	DSPX (I)	X-component of displacement
41-60	DSPY (I)	Y-component of displacement
61-80	DSPZ (I)	Z-component of displacement

N-8-5. Displacement (Node Data) (DS-FQ)

1-80 DISPLACEMENT_COMPLEXHeader

1-10	MAXING	Number of nodes with a value assigned to displacement

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	DSPX (I)	X-component of displacement (amplitude)
41-60	DSPY (I)	Y-component of displacement (amplitude)
61-80	DSPZ (I)	Z-component of displacement (amplitude)

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	DSPX (I)	X-component of displacement (phase)
41-60	DSPY (I)	Y-component of displacement (phase)
61-80	DSPZ (I)	Z-component of displacement (phase)

N-8-6. Velocity (Node Data) (DS-FQ)

1-80	VELOCITY_COMPLEX	Header

1-10	MAXING	Number of nodes with a value assigned to velocity

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	VELX (I)	X-component of velocity (amplitude)
41-60	VELY (I)	Y-component of velocity (amplitude)
61-80	VELZ (I)	Z-component of velocity (amplitude)

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	VELX_I (I)	X-component of velocity (phase)
41-60	VELY_I (I)	Y-component of velocity (phase)
61-80	VELZ_I (I)	Z-component of velocity (phase)

N-8-7. Acceleration (Node Data) (DS-FQ)

1-80	ACCELERATION_COMPLEXHeader	
1-10	MAXING	Number of nodes with a value assigned to velocity

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	ACCX (I)	X-component of velocity (amplitude)
41-60	ACCY (I)	Y-component of velocity (amplitude)
61-80	ACCZ (I)	Z-component of velocity (amplitude)

1-10	I	Order number
11-20	NNO (I)	Node number
21-40	ACCX_I (I)	X-component of velocity (phase)
41-60	ACCY_I (I)	Y-component of velocity (phase)
61-80	ACCZ_I (I)	Z-component of velocity (phase)

N-8-8. Stress (Element Data) (DS-ST)

1-80	STRESS	Header (20001)
1-10	MAXING	Number of elements with a value assigned to stress

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	ENO (I)	Node number
21-40	SX (I)	X-component of stress
41-60	SY (I)	Y-component of stress
61-80	SZ (I)	Z-component of stress
81-100	TXY (I)	XY-component of shear stress
101-120	TYZ (I)	YZ-component of shear stress
121-140	TZX (I)	ZX-component of shear stress

N-8-9. Stress (Lower Plane) (Element Data) (DS-ST)

1-80	STRESS_LOWER	Header (20008)
1-10	MAXING	Number of elements with a value assigned to stress

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	ENO (I)	Node number
21-40	SX (I)	X-component of stress
41-60	SY (I)	Y-component of stress
61-80	SZ (I)	Z-component of stress
81-100	TXY (I)	XY-component of shear stress
101-120	TYZ (I)	YZ-component of shear stress
121-140	TZX (I)	ZX-component of shear stress

N-8-10.Stress (Element Data) (DS-FQ)

1-80	STRESS_COMPLEX	Header (20004)
1-10	MAXING	Number of elements with a value assigned to stress

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	ENO (I)	Node number
21-40	SX (I)	X-component of stress (amplitude)
41-60	SY (I)	Y-component of stress (amplitude)
61-80	SZ (I)	Z-component of stress (amplitude)
81-100	TXY (I)	XY-component of shear stress (amplitude)
101-120	TYZ (I)	YZ-component of shear stress (amplitude)
121-140	TZX (I)	ZX-component of shear stress (amplitude)
1-10	I	Order number
11-20	ENO (I)	Node number
21-40	SX_I (I)	X-component of stress (phase)
41-60	SY_I (I)	Y-component of stress (phase)
61-80	SZ_I (I)	Z-component of stress (phase)
81-100	TXY_I (I)	XY-component of shear stress (phase)
101-120	TYZ_I (I)	YZ-component of shear stress (phase)
121-140	TZX_I (I)	ZX-component of shear stress (phase)

N-8-11.Stress (Lower Plane) (Element Data) (DS-FQ)

1-80	STRESS_COMPLEX_LOWER	Header (20009)
1-10	MAXING	Number of elements with a value assigned to stress

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	ENO (I)	Element ID
21-40	SX (I)	X-component of stress (amplitude)
41-60	SY (I)	Y-component of stress (amplitude)

61-80	SZ (I)	Z-component of stress (amplitude)
81-100	TXY (I)	XY-component of shear stress (amplitude)
101-120	TYZ (I)	YZ-component of shear stress (amplitude)
121-140	TZX (I)	ZX-component of shear stress (amplitude)

1-10	I	Order ID
11-20	ENO (I)	Element ID
21-40	SX_I (I)	X-component of stress (phase)
41-60	SY_I (I)	Y-component of stress (phase)
61-80	SZ_I (I)	Z-component of stress (phase)
81-100	TXY_I (I)	XY-component of shear stress (phase)
101-120	TYZ_I (I)	YZ-component of shear stress (phase)
121-140	TZX_I (I)	ZX-component of shear stress (phase)

N-8-12. Electric Potential (Node Data) (DS-ST)

1−80	VOLTAGE	Header

1-10	MAXING	Number of nodes with a value assigned to electric potential

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	VLT(I)	Electric potential

N-8-13. Electric Potential (Node Data) (DS-FQ)

1-80	VOLTAGE_COMPLEX	Header
1-10	MAXING	Number of nodes with a value assigned to electric potential

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	VLT(I)	Electric potential (amplitude)
41-60	VLT_I(I)	Electric potential (phase)

N-8-14. Charge Density (Node Data) (DS-ST)

1-80	CHARGE	Header
1-10	MAXING	Number of nodes with a value assigned to charge density

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	CHG(I)	Charge density

N-8-15. Charge Density (Node Data) (DS-FQ)

1-80	CHARGE_COMPLEX	Header
1-10	MAXING	Number of nodes with a value assigned to charge density

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	CHG(I)	Charge density (amplitude)
41-60	CHG_I(I)	Charge density (phase)

N-8-16. Sound Pressure Level (Node Data) (DS-FQ)

1-80	SOUND_PRESSURE_LEVEL_COMPLEX	Header
1-10	MAXING	Number of nodes with a value assigned to sound pressure level

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	SPL(I)	Sound pressure level [dB]
1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	SP_PHASE(I)	Phase of sound pressure [deg]

N-8-17. Sound Pressure (Node Data) (DS-FQ)

1-80	SOUND_PRESSURE_COMPLEXHeader	
1-10	MAXING	Number of nodes with a value assigned to sound pressure

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order ID
11-20	NNO(I)	Node ID
21-40	SP(I)	Amplitude of sound pressure
41-60	SP_PHASE(I)	Phase of sound pressure

N-8-18. Nodal Force (Node Data) (DS-ST)

1-80	NODAL_FORCE	Header (10008)
1-10	MAXING	Number of nodes with a value assigned to load

* Repeat the following input sequence up to the number of MAXING.

1-10	Sid	Sequential ID
11-20	Nid	Node ID
21-40	Fx	Load of X component [N]
41-60	Fy	Load of Y component [N]
61-80	Fz	Load of Z component [N]

N-8-19. Nodal Force (Node Data) (DS-FQ)

1-80	NODAL_FORCE_COMPLEX	Header (10009)
1-10	MAXING	Number of nodes with a value assigned to load

* Repeat the following input sequence up to the number of MAXING.

1-10	Sid	Sequential ID
11-20	Nid	Node ID
21-40	FxAmp	Load of X component [N]
41-60	FyAmp	Load of Y component [N]
61-80	FzAmp	Load of Z component [N]
1-10	Sid	Sequential ID
11-20	Nid	Node ID
21-40	FxPha	Phase of the load of X component [deg]
41-60	FyPha	Phase of the load of Y component [deg]
61-80	FzPha	Phase of the load of Z component [deg]

N-8-20. Pressure (Element Data)

1-80	PRESSURE	Header (20005)
1-10	MAXING	Number of elements under pressure

* Repeat the following input sequence up to the number of MAXING.

1-10	Seq.id	Order ID
11-20	Elem.id	Element ID
21-40	P	Pressure

N-8-21. Strain (Element Data) (DS-ST)

1-80	STRAIN	Header (10016)
1-10	MAXING	Number of elements with strain

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	ENO(I)	Element number
21-40	SX(I)	X-component of strain
41-60	SY(I)	Y-component of strain
61-80	SZ(I)	Z-component of strain
81-100	TXY(I)	XY-component of strain
101-120	TYZ(I)	YZ-component of strain
121-140	TZX(I)	ZX-component of strain

N-8-22.Strain (Element Data) (DS-FQ)

1-80	STRAIN_COMPLEX Header (10017)	
1-10	MAXING	Number of elements with strain

* Repeat the following input sequence up to the number of MAXING.

1-10	I	Order number
11-20	ENO(I)	Element number
21-40	SX(I)	X-component of strain (amplitude)
41-60	SY(I)	Y-component of strain (amplitude)
61-80	SZ(I)	Z-component of strain (amplitude)
81-100	TXY(I)	XY-component of shear strain (amplitude)
101-120	TYZ(I)	YZ-component of shear strain (amplitude)
121-140	TZX(I)	ZX-component of shear strain (amplitude)

1-10	I	Order number
11-20	ENO(I)	Element number
21-40	SX_I(I)	X-component of strain (phase)
41-60	SY_I(I)	Y-component of strain (phase)
61-80	SZ_I(I)	Z-component of strain (phase)
81-100	TXY_I(I)	XY-component of shear strain (phase)
101-120	TYZ_I(I)	YZ-component of shear strain (phase)
121-140	TZX_I(I)	ZX-component of shear strain (phase)