*SET

The keyword family *SET provides a convenient way of defining groups of nodes, parts, elements, and segments. The sets can be used in the definitions of contact interfaces, loading conditions, boundary conditions, and other inputs. This keyword family also provides a convenient way of defining groups of vibration modes to be used in frequency domain analysis. Each set type must have a unique numeric identification. The keyword control cards in this section are defined as follows:

SET_BEAM_*{OPTION1}_{OPTION2}

*SET_BEAM_ADD

*SET_BEAM_INTERSECT

*SET_BOX

SET_DISCRETE_*{OPTION1}_{OPTION2}

*SET_DISCRETE_ADD

SET_MODE_*{OPTION}

*SET_MULTI

*SET_MULTIMATERIAL_GROUP_LIST

SET_NODE_*{OPTION1}_{OPTION2}

SET_NODE_ADD_*{OPTION}

*SET_NODE_INTERSECT

SET_PART_*{OPTION1}_{OPTION2}

*SET_PART_ADD

*SET_PART_TREE

*SET_PERI_LAMINATE

SET_SEGMENT_*{OPTION1}_{OPTION2}

*SET_SEGMENT_ADD

*SET_SEGMENT_INTERSECT

SET_2D_SEGMENT_*{OPTION1}_{OPTION2}

SET_SHELL_*{OPTION1}_{OPTION2}

*SET_SHELL_ADD

*SET_SHELL_INTERSECT

SET_SOLID_*{OPTION1}_{OPTION2}

*SET_SOLID_ADD

*SET_SOLID_INTERSECT

SET_TSHELL_*{OPTION1}_{OPTION2}

An additional keyword option**TITLE** may be appended to all the ***SET** keywords. If this option is used, then an addition line is read for each section in 80a format which can be used to describe the set. At present, the title serves no purpose other than to perhaps lend clarity to input decks.

The **GENERAL** keyword option is available for set definitions. In this option, the commands are executed in the order defined. For example, the delete option cannot delete a node or element unless the node or element was previously added using a command such as BOX or ALL.

The **COLLECT** keyword option allows for the definition of multiple sets that share the same ID and combines them into one large set whenever this option is found. If two or more sets of the same type have definitions that share the same set IDs, they are combined if and only if the **COLLECT** option is specified in each definition. If the **COLLECT** option is not specified for one or more set definitions of the same type that share identical set IDs, an error termination will occur. For include files using ***INCLUDE_TRANSFORM** where set offsets are specified, the offsets are not applied for the case where the **COLLECT** option is present.

***SET_BEAM**_*{OPTION1}_{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

GENERATE

GENERATE_INCREMENT

GENERAL

For *OPTION2* the available option is:

COLLECT

The GENERATE and GENERATE_INCREMENT options will generate block(s) of beam element ID's between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the set.

Purpose: Define a set of beam elements or a set of seat belt elements (see BSID of *DATABASE_CROSS_SECTION_SET).

Card Summary:

Card 1. This card is required.

SID							

Card 2a. Include this card if the keyword option is unset (<BLANK>). Include as many cards as needed. This input ends at the next keyword ("*") card.

K1	K2	K3	K4	K5	K6	K7	K8

Card 2b. Include this card if the GENERATE option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. Include this card if the GENERATE_INCREMENT option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Card 2d. Include this card if the GENERAL option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

VARIABLE	DESCRIPTION
SID	Set ID

Beam Element ID Cards. This Card 2 format applies to the case of an unset (<BLANK>) keyword option. Set one value per element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	K1	K2	K3	K4	K5	K6	K7	K8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
K*i*	i^{th} beam element

Beam Element Range Cards. This Card 2 format applies to the GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of elements. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First beam element ID in block N.

VARIABLE	DESCRIPTION
B[N]END	Last beam element ID in block N. All defined ID's between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the element numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the ID's and not element ID's.

Beam Element Range with Increment Cards. This Card 2 format applies to the GENERATE_INCREMENT keyword option. For each block of elements add one card to the deck. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First beam element ID in block.
BEND	Last beam element ID in block.
INCR	Beam ID increment. Beam IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Generalized Beam Element Range Cards. This Card 2 format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2d	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, …, E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of E*n* left unspecified are ignored.

Note that the order of the selected operations matters. Elements are only excluded from the set if they were previously added to the set. For instance, if you exclude beam element 5 and then include it, element 5 will be included in the set. For the example set below, suppose that part 6 includes beam elements 10, 15, 20, and 32, box 7 contains beam elements 5, 20, and 32, and part 10 includes beam elements 5, 22, and 106. Then, beam element set 1 contains beam elements 5, 10, 15, 22, and 106.

```
*SET_BEAM_GENERAL
1
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All beam elements will be included in the set.
BOX	Elements inside boxes E1, E2, E3, ... will be included. (see *DEFINE_BOX)
DBOX	Previously added elements that are inside boxes E1, E2, E3, ... will be excluded.
ELEM	Elements E1, E2, E3, ... will be included.
DELEM	Elements E1, E2, E3, ... if previously added will be excluded.
PART	Elements of parts E1, E2, E3, ... will be included.
DPART	Elements that have been previously added and are of parts E1, E2, E3, ... will be excluded.
SET	Elements of beam element sets E1, E2, E3, … will be included.
DSET	Previously added elements that are members of beam element sets E1, E2, E3, … will be excluded.

*SET_BEAM_ADD

Purpose: Define a beam set by combining beam sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Beam Element Set Cards. Each card can be used to specify up to 8 beam element sets. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	BSID1	BSID2	BSID3	BSID4	BSID5	BSID6	BSID7	BSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new beam set. All beam sets should have a unique set ID.
BSID[N]	The N^{th} beam set ID on the card

*SET_BEAM_INTERSECT

Purpose: Define a beam set as the intersection, ∩, of a series of beam sets. The new beam set, SID, contains only the elements common to of all beam sets listed on the cards of format 2.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Beam Set Cards. Each card can be used to specify up to 8 beam sets. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	BSID1	BSID2	BSID3	BSID4	BSID5	BSID6	BSID7	BSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new beam set. All beam sets should have a unique set ID.
BSID[N]	The N^{th} beam set ID on Card 2

*SET_BOX

Purpose: Define a set of boxes. See *DEFINE_BOX.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Box Set Cards. Each card can be used to specify up to 8 box IDs. Include as many cards as desired. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	BID1	BID2	BID3	BID4	BID5	BID6	BID7	BID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new box set. All box sets should have a unique set ID.
BID[N]	The N^{th} box ID

***SET_DISCRETE**_*{OPTION1}_{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

GENERATE

GENERAL

For *OPTION2* the available option is:

COLLECT

The option GENERATE will generate a block of discrete element IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the set.

Purpose: Define a set of discrete elements.

Card Summary:

Card 1. This card is required.

SID							

Card 2a. This card is included if the keyword option is unset (<BLANK>). Include as many cards as needed. This input ends at the next keyword ("*") card.

K1	K2	K3	K4	K5	K6	K7	K8

Card 2b. This card is included if the GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if the GENERAL keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

VARIABLE	DESCRIPTION
SID	Set ID

Discrete Element ID Cards. This card applies to the case of an unset (<BLANK>) keyword option. Set one value per element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	K1	K2	K3	K4	K5	K6	K7	K8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
K*i*	i^{th} discrete element

Discrete Element Range Cards. This card applies to the GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of elements. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First discrete element ID in block N.

VARIABLE	DESCRIPTION
B[N]END	Last discrete element ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the element numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not element IDs.

Generalized Discrete Element Range Cards. This card applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, …, E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" field in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of E*n* left unspecified are ignored.

Note that the order of the selected operations matters. Elements are only excluded from the set if they were previously added. For instance, if you exclude discrete element 5 and then include it, discrete element 5 will be included in the set. For the example set below, suppose that part 6 includes discrete elements 10, 15, 20, and 32, box 7 contains discrete elements 5, 20, and 32, and part 10 includes discrete elements 5, 22, and 106. Then, discrete element set 1 includes discrete elements 5, 10, 15, 22, and 106.

```
*SET_DISCRETE_GENERAL
1
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All discrete elements will be included in the set.
BOX	Elements inside boxes E1, E2, E3, ... will be included. (see *DEFINE_BOX)
DBOX	Previously added elements that are inside boxes E1, E2, E3, ... will be excluded.
ELEM	Elements E1, E2, E3, ... will be included.
DELEM	Elements E1, E2, E3, ... if previously added will be excluded.
PART	Elements of parts E1, E2, E3, ... will be included.
DPART	Elements that have been previously added and are of parts E1, E2, E3, ... will be excluded.
SET	Elements of discrete element sets E1, E2, E3, … will be included.
DSET	Previously added elements that are members of discrete element sets E1, E2, E3, … will be excluded.

*SET_DISCRETE_ADD

Purpose: Define a discrete set by combining discrete sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Discrete Element Set Cards. Each card can be used to specify up to 8 discrete element sets. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	DSID1	DSID2	DSID3	DSID4	DSID5	DSID6	DSID7	DSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new discrete element set. All discrete element sets must have a unique ID.
DSID[N]	The N^{th} discrete set ID on Card 2

SET_IGA_EDGE_*OPTION1_{OPTION2}_{OPTION3}

Purpose: Define a set of parametric or physical edges (see *IGA_EDGE_UVW and *IGA_-EDGE_XYZ) with optional attributes.

For *OPTION1* the available options are:

UVW

XYZ

For *OPTION2* the available options are:

<BLANK>

LIST

LIST_GENERATE

LIST_GENERATE_INCREMENT

For *OPTION3* the available option is:

COLLECT

The LIST_GENERATE and LIST_GENERATE_INCREMENT options will generate block(s) of parametric/physical edge IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the parametric/physical edge set.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER		

Card 2a. This card is included if *OPTION2* is left unset or is set to LIST. Include as many cards as needed. This input ends at the next keyword ("*") card.

EID1	EID2	EID3	EID4	EID5	EID6	EID7	EID8

Card 2b. This card is included if the GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if the LIST_GENERATE_INCREMENT keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.	0.	0.	0.	MECH		

VARIABLE	DESCRIPTION
SID	Set ID. A unique number must be chosen.
DA1	First attribute default value; see Remark 1.
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 2.

Parametric/Physical Edge ID Cards. This Card 2 format applies when *OPTION2* is LIST or unset (<BLANK>). Set one value per parametric/physical edge in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	EID1	EID2	EID3	EID4	EID5	EID6	EID7	EID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
EID*i*	i^{th} parametric/physical edge ID

Parametric/Physical Edge ID Range Cards. This Card 2 format applies to the GENERATE keyword option. Set one pair of B[N]BEG and B[N]END values per block of parametric/physical edge IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First parametric/physical edge ID in block N
B[N]END	Last parametric/physical edge ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the parametric/physical edge numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not parametric/physical edge IDs.

Parametric/Physical Edge ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of parametric/physical edges add one card to the deck. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First parametric/physical edge ID in block.
BEND	Last parametric/physical edge ID in block.

VARIABLE	DESCRIPTION
INCR	Parametric/physical edge ID increment. Parametric/physical edge IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Remarks:

1. **Parametric/Physical Edge Attributes.** Parametric/physical edge attributes can be assigned for some input types.

2. **Solvers.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

SET_IGA_FACE_*OPTION1_{OPTION2}_{OPTION3}

Purpose: Define a set of parametric or physical faces (see *IGA_FACE_UVW and *IGA_-FACE_XYZ) with optional attributes.

For *OPTION1* the available options are:

UVW

XYZ

For *OPTION2* the available options are:

<BLANK>

LIST

LIST_GENERATE

LIST_GENERATE_INCREMENT

For *OPTION3* the available option is:

COLLECT

The LIST_GENERATE and LIST_GENERATE_INCREMENT options will generate block(s) of parametric/physical face IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the parametric/physical face set.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER		

Card 2a. This card is included if *OPTION2* is left unset or is set to LIST. Include as many cards as needed. This input ends at the next keyword ("*") card.

FID1	FID2	FID3	FID4	FID5	FID6	FID7	FID8

Card 2b. This card is included if the GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if the LIST_GENERATE_INCREMENT keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.	0.	0.	0.	MECH		

VARIABLE	DESCRIPTION
SID	Set ID. A unique number must be chosen.
DA1	First attribute default value; see Remark 1.
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 2.

Parametric/Physical Face ID Cards. This Card 2 format applies to *OPTION2* set to LIST or left unset (<BLANK>). Set one value per parametric/physical face in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	FID1	FID2	FID3	FID4	FID5	FID6	FID7	FID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
FID*i*	i^{th} parametric/physical face ID

Parametric/Physical Face ID Range Cards. This Card 2 format applies to the GENERATE keyword option. Set one pair of B[N]BEG and B[N]END values per block of parametric/physical face IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First parametric/physical face ID in block N.
B[N]END	Last parametric/physical face ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the parametric/physical face numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not parametric/physical face IDs.

Parametric/Physical Face ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of parametric/physical faces add one card to the deck. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First parametric/physical face ID in block
BEND	Last parametric/physical face ID in block

VARIABLE	DESCRIPTION
INCR	Parametric/physical face ID increment. Parametric/physical face IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Remarks:

1. **Parametric/Physical Face Attributes.** Parametric/physical face attributes can be assigned for some input types.

2. **Solvers.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_IGA_POINT_UVW_{OPTION1}_{OPTION2}

Purpose: Define a set of parametric points (see *IGA_POINT_UVW) with optional attributes.

For *OPTION1* the available options are:

<BLANK>

LIST

LIST_GENERATE

LIST_GENERATE_INCREMENT

For *OPTION2* the available option is:

COLLECT

The LIST_GENERATE and LIST_GENERATE_INCREMENT options will generate block(s) of parametric point IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the parametric point set.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER		

Card 2a. This card is included if *OPTION1* is unset or is set to LIST. Include as many cards as needed. This input ends at the next keyword ("*") card.

PID1	PID2	PID3	PID4	PID5	PID6	PID7	PID8

Card 2b. This card is included if the GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if the LIST_GENERATE_INCREMENT keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.	0.	0.	0.	MECH		

VARIABLE	DESCRIPTION
SID	Set ID. A unique number must be chosen.
DA1	First attribute default value; see Remark 1.
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 2.

Parametric Point ID Cards. This Card 2 format applies to *OPTION1* set to list or left unset (<BLANK>). Set one value per parametric point in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	PID1	PID2	PID3	PID4	PID5	PID6	PID7	PID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
PID*i*	i^{th} parametric point ID

Parametric Point ID Range Cards. This Card 2 format applies to the GENERATE keyword option. Set one pair of B[N]BEG and B[N]END values per block of parametric point IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First parametric point ID in block N
B[N]END	Last parametric point ID in block N. All defined ID's between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the parametric point numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not parametric point IDs.

Parametric Point ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of parametric points add one card to the deck. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First parametric point ID in block
BEND	Last parametric point ID in block
INCR	Parametric point ID increment. Parametric point IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Remarks:

1. **Parametric Point Attributes.** Parametric point attributes can be assigned for some input types.

2. **Solvers.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_MODE_{OPTION}

Available options include:

<BLANK>

LIST

LIST_GENERATE

The last option, LIST_GENERATE, will generate a block of mode IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the set.

Purpose: Define a set of modes.

Card Summary:

Card 1. This card is required.

SID							

Card 2a. This card is included if and only if the keyword option is set to LIST or left unset. Include as many cards as needed. This input ends at the next keyword ("*") card.

MID1	MID2	MID3	MID4	MID5	MID6	MID7	MID8

Card 2b. This card is included if and only if the LIST_GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

M1BEG	M1END	M2BEG	M2END	M3BEG	M3END	M4BEG	M4END

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Mode ID Cards. This card is included when the keyword option is set to LIST *or* left unset (<BLANK>). Set one value per mode in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	MID1	MID2	MID3	MID4	MID5	MID6	MID7	MID8
Type	I	I	I	I	I	I	I	I

Mode Range Cards. This card applies to the LIST_GENERATE keyword option. Set one pair of MNBEG and MNEND values per block of modes. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	M1BEG	M1END	M2BEG	M2END	M3BEG	M3END	M4BEG	M4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set identification. All mode sets should have a unique set ID.
MID[N]	Mode ID N.
M[N]BEG	First mode ID in block N.
M[N]END	Last mode ID in block N. All defined IDs between and including M[N]BEG and M[N]END are added to the set.

Remarks:

The available mode IDs can be found in ASCII file eigout, or binary database d3eigv.

*SET_MULTI

Note that this keyword's name has been shortened. Its older long form, however, is still also valid.

*SET_MULTI-MATERIAL_GROUP_LIST

Purpose: This command defines an ALE multi-material set ID (AMMSID) which contains a collection of one or more ALE multi-material group ID(s) (AMMGID). This provides a means for selecting any specific ALE multi-material(s). Applications include, for example, a selection of any particular fluid(s) to be coupled to a fluid-structure interaction.

Card 1	1	2	3	4	5	6	7	8
Variable	AMMSID							
Type	I							
Default	0							

Multi-Material Group ID Cards. Set one value per element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	AMMGID1	AMMGID2	AMMGID3	AMMGID4	AMMGID5	AMMGID6	AMMGID7	AMMGID8
Type	I/A	I/A	I/A	I/A	I/A	I/A	I/A	I/A
Default	0	0	0	0	0	0	0	0

VARIABLE	DESCRIPTION
AMMSID	An ALE multi-material set ID (AMMSID) which contains a collection of one or more ALE multi-material group ID(s) (AMMGID).
AMMGID*i*	Desired ALE multi-material referenced with its AMMGID for general ALE or with either its AMMGID or AMMG name (AMMGNM) for S-ALE. See Remarks.

Remarks:

For the general ALE solver, you define each AMMG with *ALE_MULTI-MATERIAL_-GROUP. In this case, each AMMG can only be referred to by their AMMGID. The AMMGID for each AMMG is based on the order of appearance of the AMMG in the input deck.

For the S-ALE solver, you can define the AMMG using *ALE_STRUCTURED_MULTI-MATERIAL_GROUP instead of *ALE_MULTI-MATERIAL_GROUP. With *ALE_-STRUCTURED_MULTI-MATERIAL_GROUP, you give each AMMG a name with the field AMMGNM. Each AMMG defined with that keyword can then be referred with either its name or its AMMGID (which is again based on order of appearance). We recommend using the name as it leads to fewer errors. For instance, if you add or delete AMMGs, then the AMMGIDs may change. Then, you must find all those references and change them accordingly. With the name, you do not need to modify the input deck for unchanged AMMGs.

*SET_NODE_{OPTION1}_{OPTION2}

For *OPTION1* the available options are:

<BLANK>

LIST

COLUMN

LIST_GENERATE

LIST_GENERATE_INCREMENT

GENERAL

LIST_SMOOTH

For *OPTION2* the available option is:

COLLECT

The LIST option generates a set for a list of node IDs. The LIST_GENERATE and LIST_-GENERATE_INCREMENT options will generate block(s) of node IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the node set. The option LIST_SMOOTH is used to define a local region on a distorted tooling mesh to be smoothed. The LIST_SMOOTH option is documented in the Local Smoothing of Tooling Mesh section of the manual page for *INTERFACE_COMPENSATION_3D. The COLUMN option is for setting nodal attributes, which pass data to other keyword cards, on a node-by-node basis.

Purpose: Define a nodal set with some identical or unique attributes.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER	ITS	

Card 2a. This card is included if the keyword option is unset (<BLANK>), LIST, or LIST_SMOOTH. Include as many cards as needed. This input ends at the next keyword ("*") card.

NID1	NID2	NID3	NID4	NID5	NID6	NID7	NID8

Card 2b. This card is included if the keyword option is COLUMN. Include one card per node in the set. This input ends at the next keyword ("*") card

NID	A1	A2	A3	A4			

Card 2c. This card is included if the LIST_GENERATE keyword option is used. Set one pair of BNBEG and BNEND values per block of nodes. This input ends at the next keyword ("*") card

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2d. This card is included if the LIST_GENERATE_INCREMENT keyword option is used. For each block of nodes add one card to the deck. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Card 2e. This card is included if the GENERAL keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Cards:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER	ITS	
Type	I	F	F	F	F	A	I	
Default	none	0.	0.	0.	0.	MECH	0	
Remark		1	1	1	1	3		

VARIABLE	DESCRIPTION
SID	Set identification. All node sets should have a unique set ID.
DA1	First nodal attribute default value
DA2	Second nodal attribute default value

VARIABLE	DESCRIPTION
DA3	Third nodal attribute default value
DA4	Fourth nodal attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.)
ITS	Specify coupling type across different scales in two-scale co-simulation. This flag should only be included for node sets that provide coupling information in the input file referred to by *INCLUDE_COSIM. EQ.1: Tied contact coupling EQ.2: Solid-in-shell immersed coupling EQ.3: Solid-in-solid immersed coupling

Node ID Cards. This Card 2 format applies to LIST and LIST_SMOOTH keyword options. Additionally, it applies to the case of an unset (<BLANK>) keyword option. Set one value per node in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	NID1	NID2	NID3	NID4	NID5	NID6	NID7	NID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
NID*i*	Node ID *i*

Node ID with Column Cards. This Card 2 format applies to the COLUMN keyword option. Include one card per node in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	NID	A1	A2	A3	A4			
Type	I	F	F	F	F			

VARIABLE	DESCRIPTION
NID	Nodal ID
A1	First nodal attribute (see Remark 2)
A2	Second nodal attribute (see Remark 2)
A3	Third nodal attribute (see Remark 2)
A4	Fourth nodal attribute (see Remark 2)

Node ID Range Cards. This Card 2 format applies to the LIST_GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of nodes. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B*n*BEG	First node ID in block *n*.
B*n*END	Last node ID in block *n*. All defined IDs between and including B*n*BEG to B*n*END are added to the set. These sets are generated after all input is read so that gaps in the node numbering are not a problem. B*n*BEG and B*n*END may simply be limits on the IDs and not nodal IDs.

Node ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of nodes add one card to the deck. This input ends at the next keyword ("*") card.

Card 2d	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First node ID in block.
BEND	Last node ID in block.
INCR	Node ID increment. Node IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Generalized Node ID Range Cards. This Card 2 format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2e	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, …, E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2e for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2e.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of "E*n*" left unspecified are ignored.

Note that the order of the selected operations matters. Nodes are only excluded from the set if they were previously added to the set. For instance, if you exclude node 5 and then include it, node 5 will be included in the set. For the example set below, suppose that part 6 includes nodes 10, 15, 20, and 32, box 7 contains nodes 5, 20, and 32, and part 10 includes nodes 5, 22, and 106. Then, node set 1 contains nodes 5, 10, 15, 22, and 106.

```
*SET_NODE_GENERAL
1
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All nodes will be included in the set.
BRANCH	Nodes inside tree branches E1, E2, E3, … will be included. (see *SET_PART_TREE)
DBRANCH	Previously added nodes that are inside tree branches E1, E2, E3, … will be excluded.
BOX	Nodes inside boxes E1, E2, E3, … will be included. (see *DEFINE_BOX)
DBOX	Previously added nodes that are inside boxes E1, E2, E3, … will be excluded.
NODE	Nodes E1, E2, E3, … will be included.
DNODE	Nodes E1, E2, E3, … if previously added will be excluded.
PART	Nodes of parts E1, E2, E3, … will be included.
DPART	Nodes that have been previously added and are of parts E1, E2, E3, … will be excluded.
SET_NODE	Nodes from node sets with IDs E1, …, E7 will be included.
DSET_NODE	Nodes that have been previously added and are from node sets with IDs E1, …, E7 will be excluded.
SET_*XXXX*	Include nodal points of element sets defined by *SET_*XXXX*_LIST, where *XXXX* could be SHELL, SOLID, BEAM, TSHELL, and DISCRETE.
SALECPT	Nodes inside a box in a structured ALE (S-ALE) mesh. E1 here is the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, E7 correspond to IMIN, IMAX, JMIN, JMAX, KMIN, KMAX. They are the minimum and the maximum nodal indices along each direction in S-ALE mesh. This option is only to be used for S-ALE meshes. It can be used with SALEFAC but should not be used with other GENERAL options. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.

OPTION	DESCRIPTION
SALEFAC	Nodes that are on the face of an S-ALE mesh. E1 gives the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, E7 correspond to -x, +x, -y, +y, -z, +z faces. Assigning 1, for instance, to these 6 values would include nodes belonging to all the surface segments at these faces in the node set. This option is only to be used for S-ALE mesh. It can be used with SALECPT but should not be used with other GENERAL options. For trimmed S-ALE meshes (see *ALE_STRUCTURED_MESH_-TRIM), a segment is treated as a surface segment as long as it has no neighboring element along the specified direction. The set, thus, includes the nodes of surface segments belonging to exterior and interior boundaries. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
VOL	Nodes inside contact volumes E1, E2, E3, … will be included. See *DEFINE_CONTACT_VOLUME.
DVOL	Previously added nodes that are inside contact volumes E1, E2, E3, … will be excluded.

Remarks:

1. **Nodal attributes.** Nodal attributes can be assigned to pass data to other keywords. For example, for contact option, *CONTACT_TIEBREAK_NODES_TO_-SURFACE the attributes are:

   DA1 = NFLF ⇒ Normal failure force,

   DA2 = NSFL ⇒ Shear failure force,

   DA3 = NNEN ⇒ Exponent for normal force,

   DA4 = NMES ⇒ Exponent for shear force.

2. **Overriding nodal attributes.** The nodal attributes set in Card 1 can be overridden on a node-by-node basis by using the COLUMN keyword option. Card 2b for this keyword option allows the user to set the attributes for each node. If left unset on Card 2b, the values default to those set in Card 1, that is, A1 = DA1, etc.

3. **Solvers.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics solver's mesh.

4. **LIST_SMOOTH option.** The option *SET_NODE_LIST_SMOOTH is used for localized tooling surface smoothing, and it is used in conjunction with keywords *INTERFACE_COMPENSATION_NEW_LOCAL_SMOOTH, *INCLUDE_COMPENSATION_ORIGINAL_RIGID_TOOL, and *INCLUDE_COMPENSATION_NEW_RIGID_TOOL.

***SET_NODE_ADD**_{OPTION}_

Available options include:

<BLANK>

ADVANCED

Purpose: Define a node set by combining node sets or for the ADVANCED option by combining, NODE, SHELL, SOLID, BEAM, SEGMENT, DISCRETE and THICK SHELL sets.

Card 1	1	2	3	4	5	6	7	8
Variable	NSID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	none	none	none	none	MECH		

Node Set Cards. This card is included when the keyword option is left unset (<BLANK>). Each card can be used to specify up to 8 node set IDs. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	NSID1	NSID2	NSID3	NSID4	NSID5	NSID6	NSID7	NSID8
Type	I	I	I	I	I	I	I	I

Node Set Advanced Cards. This card is included when the keyword option is set to ADVANCED. Each card can be used to specify up to 4 set IDs (node sets, beam sets, etc…). Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	SID1	TYPE1	SID2	TYPE2	SID3	TYPE3	SID4	TYPE4
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
NSID	Set ID of new node set. All node sets should have a unique set ID.
DA1	First nodal attribute default value; see Remark 1 below.
DA2	Second nodal attribute default value
DA3	Third nodal attribute default value
DA4	Fourth nodal attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 1.
NSID[N]	The N^{th} node set ID on Card 2a.
SID[N]	The N^{th} set ID on Card 2b.
TYPE[N]	Type of set for SID[N]: EQ.1: Node set EQ.2: Shell set EQ.3: Beam set EQ.4: Solid set EQ.5: Segment set EQ.6: Discrete set EQ.7: Thick shell set

Remarks:

1. **Solvers and Mesh.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_NODE_INTERSECT

Purpose: Define a node set as the intersection, ∩, of a series of node sets. The new node set, NSID, contains all common elements of all node sets listed on all cards in format 2.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.	0.	0.	0.	MECH		
Remarks						1		

Node Set Cards. For each SID in the intersection specify one field. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	NSID1	NSID2	NSID3	NSID4	NSID5	NSID6	NSID7	NSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new node set. All node sets should have a unique set ID.
DA*i*	i^{th} nodal attribute
SOLVER	Name of solver using this set (MECH, CESE, etc.)
NSID[N]	The N^{th} node set ID.

Remarks:

1. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

***SET_PART**_*{OPTION1}_{OPTION2}*

For *OPTION1* available options are:

<BLANK>

COLUMN

GENERAL

LIST

LIST_GENERATE

LIST_GENERATE_INCREMENT

For *OPTION2* the available option is:

COLLECT

The LIST_GENERATE and LIST_GENERATE_INCREMENT options will generate block(s) of part IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the part set.

Purpose: Define a set of parts with optional attributes. For the COLUMN option, see *AIRBAG or *CONSTRAINED_RIGID_BODY_STOPPERS.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER		

Card 2a. This card is included if the keyword option is left unset or is LIST. Include as many cards as needed. This input ends at the next keyword ("*") card.

PID1	PID2	PID3	PID4	PID5	PID6	PID7	PID8

Card 2b. This card is included if the COLUMN keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

PID	A1	A2	A3	A4			

Card 2c. This card is included if the LIST_GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2d. This card is included if the LIST_GENERATE_INCREMENT keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Card 2e. This card is included if *OPTION1* is GENERAL. Include as many cards as necessary. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Cards:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.	0.	0.	0.	MECH		

VARIABLE	DESCRIPTION
SID	Set ID. All part sets should have a unique set ID.
DA1	First attribute default value; see Remark 1.
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 3.

Part ID Cards. This Card 2 format applies to the LIST keyword option and the unset (<BLANK>) keyword option. Set one value per part in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	PID1	PID2	PID3	PID4	PID5	PID6	PID7	PID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
PID*i*	i^{th} part ID

Part ID with Column Cards. This Card 2 format applies to the COLUMN keyword option. Include one card per part in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	PID	A1	A2	A3	A4			
Type	I	F	F	F	F			
Remark		2	2	2	2			

VARIABLE	DESCRIPTION
PID	Part ID
A1	First part attribute
A2	Second part attribute
A3	Third part attribute
A4	Fourth part attribute

Part ID Range Cards. This Card 2 format applies to the LIST_GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of part IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First part ID in block N.
B[N]END	Last part ID in block N. All defined ID's between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the part numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the ID's and not part ID's.

Part ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of parts add one card to the deck. This input ends at the next keyword ("*") card.

Card 2d	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First part ID in block.
BEND	Last part ID in block.
INCR	Part ID increment. Part IDs BBEG, BBEG+INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Generalized Part ID Range Cards. This Card 2 format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2e	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below
E1, …, E7	Specified entity. Each card must have an option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of "E*n*" left unspecified are ignored.

Note that the order of the selected operations matters. Parts are only excluded from the set if they were previously added to the set. Consider the following example:

```
*SET_PART
1
1,2
*SET_PART
2
2,3
*SET_PART_GENERAL
1001
SET,1
DSET,2
*SET_PART_GENERAL
1002
DSET,2
SET,1
```

Because of the order dependence, part sets 1001 and 1002 are not the same. Part set 1001 includes part 1 while part set 1002 includes parts 1 and 2.

OPTION	DESCRIPTION
ALL	All parts will be included in the set.
PART	Parts E1, …, E7 will be included.
DPART	Parts E1, …, E7 if previously added will be excluded.
SET	Parts of part sets E1, …, E7 will be included.
DSET	Previously added parts that are members of part sets E1, …, E7 will be excluded.

Remarks:

1. **Part Attributes.** Part attributes can be assigned for some input types. For example, for airbags a time delay, DA1 = T1, can be defined before pressure begins to act along with a time delay, DA2 = T2, before full pressure is applied (default T2 = T1). For *CONSTRAINED_RIGID_BODY_STOPPERS one attribute can be defined: DA1 as the closure distance which activates the stopper constraint.

2. **Individual Part Attributes.** The default part attributes can be overridden on the part cards with the COLUMN keyword option; otherwise, A1 = DA1, etc.

3. **Solvers.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_PART_ADD

Purpose: Define a part set by combining part sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER		
Type	I	F	F	F	F	A		
Default	none	0.0	0.0	0.0	0.0	MECH		
Remarks		1, 2	1, 2	1, 2	1, 2	3		

Part Set Cards. Each card can be used to specify up to 8 part set IDs. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2…	1	2	3	4	5	6	7	8
Variable	PSID1	PSID2	PSID3	PSID4	PSID5	PSID6	PSID7	PSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID. All part sets should have a unique set ID.
DA1	First attribute default value
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value
SOLVER	Name of solver using this set (MECH, CESE, etc.)
PSID[N]	The N^{th} part set ID GT.0: PSID[N] is added to SID, LT.0: all part sets with ID between PSID[N-1] and -PSID[N], including PSID[N-1] and -PSID[N], will be added to SID.

VARIABLE	DESCRIPTION
	PSID[N-1] must be > 0 and must have a magnitude smaller or equal to -PSID[N] when PSID[N] < 0.

Remarks:

1. **Part attributes.** Part attributes can be assigned for some input types. For example, for airbags a time delay, DA1 = T1, can be defined before pressure begins to act along with a time delay, DA2 = T2, before full pressure is applied, (default T2 = T1). For the constraint option, *CONSTRAINED_RIGID_BODY_STOPPERS one attribute can be defined: DA1, the closure distance which activates the stopper constraint.

2. **Overriding part attributes.** The default values for the part attributes are given in the contributing *SET_PART_{*OPTION*} commands. Nonzero values of DA1, DA2, DA3, or DA4 in *SET_PART_ADD will override the respective default values.

3. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_PART_TREE

Purpose: Define a branch in a tree structure. A branch is a part set that can be defined using parts and/or sub-branches. With this keyword, the whole model can be modeled as a hierarchical tree structure.

Card Summary:

Card 1. This card is required.

BRID							

Card 2. This card is required.

HEADING	

Card 3. Include as many cards as needed. This input ends at the next keyword ("*") card.

COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	COMP7	COMP8

Data Cards:

Card 1	1	2	3	4	5	6	7	8
Variable	BRID							
Type	I							
Default	none							

VARIABLE	DESCRIPTION
BRID	Branch identification. A unique number must be specified.

Card 2	1	2	3	4	5	6	7	8
Variable	HEADING							
Type	C							
Default	none							

VARIABLE	DESCRIPTION
HEADING	Heading for the branch

Component Data Cards. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 3	1	2	3	4	5	6	7	8
Variable	COMP1	COMP2	COMP3	COMP4	COMP5	COMP6	COMP7	COMP8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
COMP*i*	Components of branch BRID: GT.0: ID of a sub-branch LT.0: ID of a part

Remarks:

1. A branch is basically a part set. A branch that does *not* belong to any other branch is considered to belong to the root of the whole model.

2. A branch or part cannot belong to more than one branch.

3. Parts which are never referenced, directly or indirectly, in *SET_PART_TREE are considered the children of the root of the whole model.

*SET_PERI_LAMINATE

Purpose: Assemble laminae (each lamina must be defined as one individual part) into a laminate and define the fiber angles for laminae.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Repeat this card as many times as needed to specify each lamina of the laminate. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	PID1	A1	T1	PID2	A2	T2		
Type	I	F	F	I	F	F		

VARIABLE	DESCRIPTION
SID	Set ID for the laminate
PID*i*	Part ID of i^{th} lamina
A*i*	Fiber angle of i^{th} lamina. This angle is relative to the direction (V1,V2,V3) specified in *MAT_ELASTIC_PERI_LAMINATE
T*i*	Thickness of i^{th}

*SET_SEGMENT_{OPTION1}_{OPTION2}

For *OPTION1* the available options are:

<BLANK>

GENERAL

For *OPTION2* the available option is

COLLECT

Purpose: Define a set of segments with optional identical or unique attributes. For three-dimensional geometries, a segment can be triangular or quadrilateral. For two-dimensional geometries, a segment is a line defined by two nodes and the GENERAL option does not apply.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4	SOLVER	ITS	

Card 2a. This card is included if *OPTION1* is <BLANK>. Include as many cards as necessary. This input ends at the next keyword ("*") card.

N1	N2	N3	N4	A1	A2	A3	A4

Card 2b. This card is included if *OPTION1* is GENERAL. Include as many cards as necessary. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Cards:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4	SOLVER	ITS	
Type	I	F	F	F	F	A	I	
Default	none	0.	0.	0.	0.	MECH	0	

VARIABLE	DESCRIPTION
SID	Set ID. All segment sets should have a unique set ID.
DA1	First segment attribute default value. See Remark 1.
DA2	Second segment attribute default value. See Remark 1.
DA3	Third segment attribute default value. See Remark 1.
DA4	Fourth segment attribute default value. See Remark 1.
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 3.
ITS	Define coupling type across different scales in two-scale co-simulation. This flag should only be included for segment sets that provide coupling information in the input file referred to by *INCLUDE_COSIM. EQ.1: Tied contact coupling EQ.2: Solid-in-shell immersed coupling

Segment Cards. For each segment in the set include one card of this format unless the GENERAL option is used. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	N1	N2	N3	N4	A1	A2	A3	A4
Type	I	I	I	I	F	F	F	F

VARIABLE	DESCRIPTION
N1	Nodal point n_1
N2	Nodal point n_2
N3	Nodal point n_3
N4	Nodal point n_4. To define a triangular segment, set N4 = N3.
A1	First segment attribute. See Remark 2.
A2	Second segment attribute. See Remark 2.

VARIABLE	DESCRIPTION
A3	Third segment attribute. See Remark 2.
A4	Fourth segment attribute. See Remark 2.

Generalized Part ID Range Cards. This Card 2 format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I or F	I or F	I or F	I or F

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, …, E7	Specified entity. Each card must have an option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of "E*n*" left unspecified are ignored.

OPTION	DESCRIPTION
ALL	All exterior segments will be included in the set.
BOX	Generate segments inside boxes having IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. For shell elements, one segment per shell is generated. For solid elements, only those segments wrapping the solid part and pointing outward from the part will be generated.

OPTION	DESCRIPTION
BOX_SHELL	Generate segments inside boxes having IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. The segments are only generated for shell elements. One segment per shell is generated.
BOX_SLDIO	Generate segments inside boxes having IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. Both exterior segments and inter-element segments are generated.
BOX_SOLID	Generate segments inside boxes having IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. The segments are only generated for exterior solid elements
BRANCH	Generate segments from tree branches E1, E2, and E3 with attributes E4, E5, E6, and E7. For shell elements one segment per shell is generated. For solid elements, only those segments wrapping the solid part and pointing outward from the part will be generated. See *SET_PART_TREE.
BRANCH_IO	Generate segments from tree branches E1, E2, and E3 with attributes E4, E5, E6, and E7. Same as the BRANCH option above except that inter-element segments inside parts will be generated as well. This option is sometimes useful for single surface contact of solid elements to prevent negative volumes.
BRSLDF*i*	Generate segments from the *i*th face of solid tree branches E1, E2, and E3 with attributes E4, E5, E6, and E7. See Table 43-1 below for the face definition.
DBOX	Segments inside boxes with IDs E1, …, E7 will be excluded.
DBOX_SHELL	Shell-related segments inside boxes of IDs E1, …, and E7 will be excluded.
DBOX_SOLID	Solid-related segments inside boxes of IDs E1, …, and E7 will be excluded.
DPART	Segments of parts with IDs E1, …, and E7 will be excluded.
DSEG	Segment with node IDs E1, E2, E3, and E4 will be deleted.
DVOL	Segments inside contact volumes having IDs E1, …, and E7 will be excluded.
DVOL_SHELL	Shell-related segments inside contact volumes having IDs E1, …, and E7 will be excluded.

OPTION	DESCRIPTION
DVOL_SOLID	Solid-related segments inside contact volumes having IDs E1, …, and E7 will be excluded.
PART	Generate segments from parts E1, E2, and E3 with attributes E4, E5, E6, and E7. For shell elements, one segment per shell is generated. For solid elements, only those segments wrapping the solid part and pointing outward from the part will be generated. PART could refer to beam parts when defining 2D segments for traction application.
PART_IO	Generate segments from parts E1, E2, and E3 with attributes E4, E5, E6, and E7. Same as the PART option above except that inter-element segments inside parts will be generated as well. This option is sometimes useful for single surface contact of solid elements to prevent negative volumes.
PSLDF*i*	Generate segments from the i^{th} face of solid parts E1, E2, and E3 with attributes E4, E5, E6, and E7. See Table 43-1 below for face definition.
SALECPT	Segments inside a box in a structured ALE (S-ALE) mesh. E1 here is the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, and E7 correspond to IMIN, IMAX, JMIN, JMAX, KMIN, and KMAX. They are the minimum and the maximum nodal indices along each direction in the S-ALE mesh. This option is only to be used for Structured ALE mesh. It can be used with SALEFAC but should not be used with other GENERAL options. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SALEFAC	Segments on the face of an S-ALE mesh. E1 here is the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, E7 correspond to -X, +X, -Y, +Y, -Z, +Z faces. Assigning 1 to these 6 values would include all the surface segments at these faces in the segment set. This option is only to be used for S-ALE meshes. It can be used with SALECPT but should not be used with other GENERAL options. For trimmed S-ALE meshes (see *ALE_STRUCTURED_MESH_TRIM), a segment is treated as a surface segment as long as it has no neighboring element along the specified direction. The set thus includes all surface segments facing that direction at the exterior and interior boundaries.

OPTION	DESCRIPTION
	Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SEG	Create a segment with node IDs E1, E2, E3, and E4.
SET_SHELL	Generate segments from shell elements in shell sets created with *SET_SHELL_LIST with IDs E1, E2, and E3. E4, E5, E6, and E7 set the attributes.
SET_SOLID	Generate segments from solid elements in solid sets created with *SET_SOLID_LIST with IDs E1, E2, and E3. E4, E5, E6, and E7 set the attributes.
SET_SLDIO	Generate segments for solid elements in solid sets created with *SET_SOLID_LIST with IDs E1, E2, and E3. E4, E5, E6, and E7 set the attributes. Both exterior and interior segments are generated.
SET_SLDF*i*	Generate segments from the i^{th} face of solid elements in the solid element sets created with *SET_SOLID_LIST with IDs E1, E2, and E3. E4, E5, E6, and E7 set the attributes. See Table 43-1 below for face definitions.
SET_TSHELL	Generate segments from thick shell elements in the thick shell sets created with *SET_TSHELL_LIST with IDs of E1, E2, and E3. E4, E5, E6, and E7 set the attributes. Only exterior segments are generated.
SET_TSHIO	Generate segments from thick shell elements in the thick shell sets created with *SET_TSHELL_LIST with IDs of E1, E2, and E3. E4, E5, E6, and E7 set the attributes. Both exterior and interior segments are generated.
SHELL	Generate segments for shell elements with IDs of E1, E2, and E3 with attributes having values E4, E5, E6, and E7.
VOL	Generate segments inside contact volume IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. See BOX option for other details. See *DEFINE_CONTACT_VOLUME.
VOL_SHELL	Generate segments from shells inside contact volume IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7
VOL_SLDIO	Generate segments from solid elements inside contact volume IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. See BOX_SLDIO for other details.

OPTION	DESCRIPTION
VOL_SOLID	Generate segments from solid elements inside contact volume IDs E1, E2, and E3 with attributes having values E4, E5, E6, and E7. See BOX_SOLID for other details.

Table 43-1. Face definition of solid elements

Face	Hexahedron	Pentahedron	Tetrahedron
1	N1, N5, N8, N4	N1, N2, N5	N1, N2, N4
2	N2, N3, N7, N6	N4, N6, N3	N2, N3, N4
3	N1, N2, N6, N5	N1, N4, N3, N2	N1, N3, N2
4	N4, N8, N7, N3	N2, N3, N6, N5	N1, N4, N3
5	N1, N4, N3, N2	N1, N5, N6, N4	
6	N5, N6, N7, N8		

Remarks:

1. **Segment attributes.** Segment attributes can be assigned for some input types. For example, for the contact options:

   The attributes for the SURFA surface are:

   DA1 (NFLS) = Normal failure stress, *CONTACT_TIEBREAK_SURFACE_... contact only,

   DA2 (SFLS) = Shear failure stress, *CONTACT_TIEBREAK_SURFACE_... contact only,

   DA3 (FSF) = Coulomb friction scale factor,

   DA4 (VSF) = Viscous friction scale factor,

   and the attributes for the SURFB surface are:

   DA3 (FSF) = Coulomb friction scale factor,

   DA4 (VSF) = Viscous friction scale factor.

   For airbags, see *AIRBAG, a time delay, DA1 = T1, can be defined before pressure begins to act on a segment along with a time delay, DA2 = T2, before full pressure is applied to the segment, (default T2 = T1), and for the constraint option,

2. **Setting individual attributes.** The default segment attributes can be overridden on Card 2a; otherwise, A1 = DA1, A2 = DA2, etc.

3. **Solvers.** The SOLVER field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics' mesh.

*SET_SEGMENT_ADD

Purpose: Define a segment set by combining segment sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	SOLVER						
Type	I	A						
Default	none	MECH						
Remarks		1						

Segment Set Cards. Each card can be used to specify up to 8 segment set IDs. Include as many cards of this kind as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new segment set. All segment sets should have a unique set ID.
SOLVER	Name of solver using this set (MECH, CESE, etc.)
SSID[N]	The N^{th} segment set ID.

Remarks:

1. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_SEGMENT_INTERSECT

Purpose: Define a segment set as the intersection, ∩, of a series of segment sets. The new segment set, SID, contains all segments common to the sets listed on all of the cards in format 2.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	SOLVER						
Type	I	A						
Default	none	MECH						
Remarks		1						

Segment Set Cards. For each SID in the intersection specify one field. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new segment set. All segment sets should have a unique set ID.
SOLVER	Name of solver using this set (MECH, CESE, etc.)
SSID[N]	The N^{th} segment set ID

Remarks:

1. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

***SET_SHELL**_*{OPTION1}*_*{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

LIST

COLUMN

LIST_GENERATE

LIST_GENERATE_INCREMENT

GENERAL

For *OPTION2* the available option is:

COLLECT

The LIST_GENERATE and LIST_GENERATE_INCREMENT options will generate block(s) of shell element IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the shell element set.

Purpose: Define a set of shell elements with optional identical or unique attributes.

Card Summary:

Card 1. This card is required.

SID	DA1	DA2	DA3	DA4			

Card 2a. Include this card if the keyword option is unused or if the LIST keyword option is used. Set one value per element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

EID1	EID2	EID3	EID4	EID5	EID6	EID7	EID8

Card 2b. Include this card if the COLUMN keyword option is used. Include one card per shell element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

EID	A1	A2	A3	A4			

Card 2c. Include this card if the LIST_GENERATE keyword option is used. Set one pair of BNBEG and BNEND values per block of shell element IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2d. Include this card if the LIST_GENERATE_INCREMENT keyword option is used. For each block of shell elements add one card to the deck. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Card 2e. Include this card if the GENERAL keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4			
Type	I	F	F	F	F			
Default	none	0.	0.	0.	0.			
Remarks		1	1	1	1			

VARIABLE	DESCRIPTION
SID	Set ID. All shell sets should have a unique set ID.
DA1	First attribute default value
DA2	Second attribute default value
DA3	Third attribute default value
DA4	Fourth attribute default value

Shell Element ID Cards. This Card 2 format applies to the LIST keyword option. Additionally, it applies to the case of an unset (<blank>) keyword option. Set one value per element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	EID1	EID2	EID3	EID4	EID5	EID6	EID7	EID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
EID*i*	i^{th} shell element ID

Shell Element ID with Column Cards. This Card 2 format applies to the COLUMN keyword option. Include one card per shell element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	EID	A1	A2	A3	A4			
Type	I	F	F	F	F			
Remarks		2	2	2	2			

VARIABLE	DESCRIPTION
EID	Element ID
A1	First attribute
A2	Second attribute
A3	Third attribute
A4	Fourth attribute

Shell Element ID Range Cards. This Card 2 format applies to the LIST_GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of shell element IDs. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First shell ID in shell block N.
B[N]END	Last shell ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the element numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not element IDs.

Shell Element ID Range with Increment Cards. This Card 2 format applies to the LIST_GENERATE_INCREMENT keyword option. For each block of shell elements add one card to the deck. This input ends at the next keyword ("*") card.

Card 2d	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First shell element ID in block.
BEND	Last shell element ID in block.
INCR	Shell element ID increment. Shell element IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Generalized Shell Element ID Range Cards. This Card 2 format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2e	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, …, E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accepts up to 7 arguments, but they may take fewer. Values of "E*n*" left unspecified are ignored.

Note that the order of the selected operations matters. Elements are only excluded from the set if they were previously added to the set. For instance, if you exclude shell element 5 and then include it, element 5 will be included in the set. For the example set below, suppose that part 6 includes shell elements 10, 15, 20, and 32, box 7 contains shell elements 5, 20, and 32, and part 10 includes shell elements 5, 22, and 106. Then, shell element set 1 contains shell elements 5, 10, 15, 22, and 106.

```
*SET_SHELL_GENERAL
1
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All shell elements will be included in the set.
BOX	Shell elements inside boxes E1, E2, E3, … will be included. See *DEFINE_BOX.

OPTION	DESCRIPTION
DBOX	Previously added shell elements that are inside boxes E1, E2, E3, … will be excluded.
ELEM	Shell elements E1, E2, E3, … will be included.
DELEM	Shell elements E1, E2, E3, … if previously added will be excluded.
PART	Shell elements of parts E1, E2, E3, … will be included.
DPART	Shell elements that have been previously added and are of parts E1, E2, E3, … will be excluded.
SALECPT	Elements inside a box for a 2D Structured ALE (S-ALE) mesh. E1 is the S-ALE mesh ID (MSHID). E2, E3, E4, and E5 correspond to IMIN, IMAX, JMIN, and JMAX, respectively. They are the minimum and the maximum nodal indices along each direction in the S-ALE mesh. This option is only to be used for S-ALE meshes. It can be used with SALEFAC to generate a shell set but should not be used with other GENERAL options. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SALEFAC	Elements on the face of a 2D S-ALE mesh. E1 is the S-ALE mesh ID (MSHID). E2, E3, E4, and E5 correspond to the -*X*, +*X*, -*Y*, and +*Y* faces, respectively. Assigning 1 to these 4 values would include all the boundary elements at these faces in the shell element set. This option is only to be used for a Structured ALE mesh. It can be used with SALECPT to generate a shell set but should not be used with other GENERAL options. For trimmed S-ALE meshes (see *ALE_STRUCTURED_MESH_TRIM), an element is treated as a surface element as long as it has no neighboring element along the specified direction. The set thus includes all surface elements facing that direction at exterior and interior boundaries. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SET	Elements of shell element sets (*SET_SHELL) E1, E2, E3, … will be included.

OPTION	DESCRIPTION
DSET	Previously added elements that are members of shell element sets E1, E2, E3, ... will be excluded.

Remarks:

1. **Shell attributes.** Shell attributes can be assigned for some input types.

   For example, for contact options, the attributes for the SURFA surface are:

   DA1 (NFLS) = Normal failure stress, *CONTACT_TIEBREAK_SURFACE_... contact only,

   DA2 (SFLS) = Shear failure stress, *CONTACT_TIEBREAK_SURFACE_... contact only,

   DA3 (FSF) = Coulomb friction scale factor,

   DA4 (VSF) = Viscous friction scale factor,

   and the attributes for the SURFB surface are:

   DA1 (FSF) = Coulomb friction scale factor,

   DA2 (VSF) = Viscous friction scale factor.

2. **Overriding shell attributes.** The default shell attributes for the set can be overridden for individual elements using Card 2b; otherwise, A1 = DA1, etc.

*SET_SHELL_ADD

Purpose: Define a shell set by combining shell sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Shell Element Set Cards. Each card can be used to specify up to 8 shell element set IDs. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new shell set. All shell sets should have a unique set ID.
SSID[N]	The N^{th} shell set ID on Card 2

*SET_SHELL_INTERSECT

Purpose: Define a shell set as the intersection, ∩, of a series of shell sets. The new shell set, SID, contains all shells common to all sets on the cards of format 2.

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							
Default	none							

Shell Element Set Cards. For each shell element SID in the intersection input one field. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new shell set. All shell sets should have a unique set ID.
SSID[N]	The N^{th} shell set ID

***SET_SOLID**_*{OPTION1}_{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

GENERATE

GENERATE_INCREMENT

GENERAL

For *OPTION2* the available option is:

COLLECT

The GENERATE and GENERATE_INCREMENT options will generate block(s) of solid element IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the solid element set.

Purpose: Define a set of solid elements.

Card Summary:

Card 1. This card is required.

SID	SOLVER	ITS					

Card 2a. This card is included if the keyword option is left unset (<BLANK>). Set one value per solid element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

K1	K2	K3	K4	K5	K6	K7	K8

Card 2b. This card is included if the keyword option GENERATE is used. Set one pair of BNBEG and BNEND values per block of solid elements. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if the keyword option GENERATE_INCREMENT is used. For each block of solid elements add one card to the deck. This input ends at the next keyword ("*") card.

BBEG	BEND	INCR					

Card 2d. This card is included if the keyword option GENERAL is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID	SOLVER	ITS					
Type	I	A	I					
Default	none	MECH	0					

VARIABLE	DESCRIPTION
SID	Set ID. All solid sets should have a unique set ID.
SOLVER	Name of solver using this set (MECH, CESE, etc.). See Remark 1.
ITS	Define coupling type across different scales in two-scale co-simulation. This flag should only be included for solid sets that provide coupling information in the input file referred to by *INCLUDE_COSIM. EQ.3: Solid-in-solid immersed coupling

Solid Element ID Cards. This card format applies to the case of an unset (<BLANK>) keyword option. Set one value per solid element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	K1	K2	K3	K4	K5	K6	K7	K8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
K*i*	*i*th element ID

Solid Element ID Range Cards. This card format applies to the GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of solid elements. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First solid element ID in block N.
B[N]END	Last solid element ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the element numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not element IDs.

Solid Element ID Range with Increment Cards. This card format applies to the GENERATE_INCREMENT keyword option. For each block of solid elements add one card to the deck. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	BBEG	BEND	INCR					
Type	I	I	I					

VARIABLE	DESCRIPTION
BBEG	First solid element ID in block.
BEND	Last solid element ID in block.
INCR	Solid ID increment. Solid IDs BBEG, BBEG + INCR, BBEG + 2 × INCR, and so on through BEND are added to the set.

Generalized Solid Element ID Range Cards. This card format applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2d	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, ..., E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2d for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option of Card 2d.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of "En" left unspecified are ignored.

Note that the order of the selected operations matters. Elements are only excluded from the set if they were previously added to the set. For instance, if you exclude solid element 5 and then include it, element 5 will be included in the set. For the example set below, suppose that part 6 includes solid elements 10, 15, 20, and 32, box 7 contains solid elements 5, 20, and 32, and part 10 includes solid elements 5, 22, and 106. Then, solid element set 1 contains solid elements 5, 10, 15, 22, and 106.

```
*SET_SOLID_GENERAL
1
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All solid elements will be included in the set.
BOX	Elements inside boxes E1, E2, E3, ... will be included. See *DEFINE_BOX.

OPTION	DESCRIPTION
DBOX	Previously added elements that are inside boxes E1, E2, E3, ... will be excluded.
ELEM	Elements E1, E2, E3, ... will be included.
DELEM	Elements E1, E2, E3, ... if previously added will be excluded.
PART	Elements of parts E1, E2, E3, ... will be included.
DPART	Elements that have been previously added and are of parts E1, E2, E3, ... will be excluded.
SALECPT	Elements inside a box in a Structured ALE (S-ALE) mesh. E1 here is the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, and E7 correspond to IMIN, IMAX, JMIN, JMAX, KMIN, and KMAX. They are the minimum and the maximum nodal indices along each direction in the S-ALE mesh. This option is only to be used for S-ALE meshes. It can be used with SALEFAC but should not be used in a mixed manner with other GENERAL options. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SALEFAC	Elements on the face of the S-ALE mesh. E1 here is the S-ALE mesh ID (MSHID). E2, E3, E4, E5, E6, and E7 correspond to -*X*, +*X*, -*Y*, +*Y*, -*Z*, and +*Z* faces. Assigning 1 to these 6 values would include all the boundary elements at these faces in the solid element set. This option is only to be used for S-ALE mesh. It can be used with SALECPT but should not be used in a mixed manner with other GENERAL options. For trimmed S-ALE meshes (see *ALE_STRUCTURED_MESH_TRIM), an element is treated as a surface element as long as it has no neighboring element along the specified direction. The set thus includes all surface elements facing that direction at the exterior and interior boundaries. Please refer to *ALE_STRUCTURED_MESH_CONTROL_POINTS and *ALE_STRUCTURED_MESH for more details.
SET	Elements of solid element sets E1, E2, E3, … will be included.
DSET	Previously added elements that are members of solid element sets E1, E2, E3, ... will be excluded.

OPTION	DESCRIPTION
VOL	Elements inside contact volumes E1, E2, E3, … will be included. See *DEFINE_CONTACT_VOLUME.
DVOL	Previously added elements that are inside contact volumes E1, E2, E3, … will be excluded.

Remarks:

1. **Solvers and mesh.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics' mesh.

*SET_SOLID_ADD

Purpose: Define a solid set by combining solid sets.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	SOLVER						
Type	I	A						
Default	none	MECH						
Remarks		1						

Node Set Cards. Each card can be used to specify up to 8 solid set IDs. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new solid set. All solid sets should have a unique set ID.
SOLVER	Name of solver using this set (MECH, CESE, etc.)
SSID[N]	The N^{th} solid set ID.

Remarks:

1. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

*SET_SOLID_INTERSECT

Purpose: Define a solid set as the intersection, ∩, of a series of solid sets. The new solid set, SID, contains all common elements of all solid sets SSID*n*.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	SOLVER						
Type	I	A						
Default	none	MECH						
Remarks		1						

Solid Element Set Cards. For each solid element SID in the intersection input one field. Include as many cards as necessary. This input ends at the next keyword ("*") card.

Card 2	1	2	3	4	5	6	7	8
Variable	SSID1	SSID2	SSID3	SSID4	SSID5	SSID6	SSID7	SSID8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
SID	Set ID of new solid set. All solid sets should have a unique set ID.
SOLVER	Name of solver using this set (MECH, CESE, etc.)
SSID[N]	The N^{th} solid set ID

Remarks:

1. **Solver.** This field is used by a non-mechanics solver to create a set defined on that solver's mesh. By default, the set refers to the mechanics mesh.

***SET_TSHELL**_*{OPTION1}_{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

GENERATE

GENERAL

For *OPTION2* the available option is:

COLLECT

The option GENERATE will generate a block of thick shell element IDs between a starting ID and an ending ID. An arbitrary number of blocks can be specified to define the set.

Purpose: Define a set of thick shell elements.

Card Summary:

Card 1. This card is required.

SID							

Card 2a. This card is included if and only if the keyword option is unset (<BLANK>). Include as many cards as needed. This input ends at the next keyword ("*") card.

K1	K2	K3	K4	K5	K6	K7	K8

Card 2b. This card is included if and only if the GENERATE keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END

Card 2c. This card is included if and only if the GENERAL keyword option is used. Include as many cards as needed. This input ends at the next keyword ("*") card.

OPTION	E1	E2	E3	E4	E5	E6	E7

Data Card Definitions:

Card 1	1	2	3	4	5	6	7	8
Variable	SID							
Type	I							

VARIABLE	DESCRIPTION
SID	Set ID. All tshell sets should have a unique set ID.

Thick Shell Element ID Cards. This card applies to the case of an unset (<BLANK>) keyword option. Set one value per thick shell element in the set. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2a	1	2	3	4	5	6	7	8
Variable	K1	K2	K3	K4	K5	K6	K7	K8
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
K1	First thick shell element ID
K2	Second thick shell element ID
⋮	⋮
K8	Eighth thick shell element ID

Thick Shell Element ID Range Cards. This card applies to the GENERATE keyword option. Set one pair of BNBEG and BNEND values per block of thick shell elements. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2b	1	2	3	4	5	6	7	8
Variable	B1BEG	B1END	B2BEG	B2END	B3BEG	B3END	B4BEG	B4END
Type	I	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
B[N]BEG	First thick shell element ID in block N.
B[N]END	Last thick shell element ID in block N. All defined IDs between and including B[N]BEG to B[N]END are added to the set. These sets are generated after all input is read so that gaps in the element numbering are not a problem. B[N]BEG and B[N]END may simply be limits on the IDs and not element IDs.

Generalized Thick Shell Element ID Range Cards. This card applies to the GENERAL keyword option. Include as many cards as needed. This input ends at the next keyword ("*") card.

Card 2c	1	2	3	4	5	6	7	8
Variable	OPTION	E1	E2	E3	E4	E5	E6	E7
Type	A	I	I	I	I	I	I	I

VARIABLE	DESCRIPTION
OPTION	Option for GENERAL. See table below.
E1, ..., E7	Specified entity. Each card must have the option specified. See table below.

The General Option:

The "OPTION" column in the table below enumerates the allowed values for the "OPTION" variable in Card 2 for the GENERAL option. Likewise, the variables E1, …, E7 refer to the GENERAL option Card 2.

Each of the following operations accept up to 7 arguments, but they may take fewer. Values of "En" left unspecified are ignored.

Note that the order of the selected operations matters. Elements are only excluded from the set if they were previously added to the set. For instance, if you exclude tshell element 5 and then include it, element 5 will be included in the set. For the example set below, suppose that part 6 includes tshell elements 10, 15, 20, and 32, box 7 contains tshell elements 5, 20, and 32, and part 10 includes tshell elements 5, 22, and 106. Then, tshell element set 1 contains tshell elements 5, 10, 15, 22, and 106.

```
*SET_TSHELL_GENERAL
1
```

```
PART, 6
DBOX, 7
PART, 10
```

OPTION	DESCRIPTION
ALL	All thick shell elements will be included in the set.
BOX	Elements inside boxes E1, E2, E3, ... will be included. (see *DEFINE_BOX)
DBOX	Previously added elements that are inside boxes E1, E2, E3, ... will be excluded.
ELEM	Elements E1, E2, E3, ... will be included.
DELEM	Elements E1, E2, E3, ... if previously added will be excluded.
PART	Elements of parts E1, E2, E3, ... will be included.
DPART	Elements that have been previously added and are of parts E1, E2, E3, ... will be excluded.
SET	Elements in thick shell sets E1, E2, E3, … will be included.
DSET	Previously added elements that are members of shell element sets E1, E2, E3, … will be excluded.

***SET_2D_SEGMENT**_*{OPTION1}_{OPTION2}*

For *OPTION1* the available options are:

<BLANK>

SET

For *OPTION2* the available option is:

COLLECT

Purpose: Define a set of boundary line segments in two-dimensional axisymmetric, plane stress, and plane strain geometries with optional attributes. This command does not apply to beam formulations 7 and 8. This feature is sometimes convenient for two-dimensional parts that are subject to adaptivity because the segments in the set are updated as the geometry adapts.

Card Sets. For each set include a pair of Cards 1 and 2. This input ends at the next keyword ("*") card.

Card 1	1	2	3	4	5	6	7	8
Variable	SID	DA1	DA2	DA3	DA4			
Type	I	F	F	F	F			
Default	none	0.	0.	0.	0.			
Remarks		1	1	1	1			

Card 2	1	2	3	4	5	6	7	8
Variable	PID/PSID							
Type	I							
Remarks	2							

VARIABLE	DESCRIPTION
SID	Set ID. All segment sets should have a unique set ID.
DA1	First segment attribute default value, see Remark 1 below.
DA2	Second segment attribute default value
DA3	Third segment attribute default value
DA4	Fourth segment attribute default value
PID/PSID	Part ID or part set ID if SET option is specified.

Remarks:

1. **Axisymmetric Problems.** The boundary along $r = 0$ is not included in axisymmetric problems.

2. **Common Boundary in Part Sets.** The common boundary between parts in the part set PSID is not included in the boundary segments.