RADIOSS User's Code Interface

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Global User Window

Chapter 1

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1.0 Global User's Window

With RADIOSS, it is possible to define a global user window. This is the most general interface between RADIOSS and external code.

To define a user's window, two subroutines must be provided. One must be linked with RADIOSS Starter and the other with RADIOSS Engine.

- The Starter subroutine is called USERWIS and is used to read the global data and to initialize global memory.

- The Engine subroutine is called USERWI and is used to compute the forces and moments.

Note: All communication between RADIOSS and the subroutines takes place within the argument list.

1.1 Starter Subroutine USERWIS_INI

This subroutine reads input data and prepares the RADIOSS buffers for allocation.

The argument list of USERWIS and its individual arguments and descriptions are as follows:

```
C-------------------------------------------------------------------------------
SUBROUTINE USERWIS_INI(
.           IIN    ,IOUT   ,IUPARAM ,NUMNOD ,ITAB    ,
.           X      ,V      ,VR      ,MASS   ,INER    ,
.           NUVAR  ,NUVARI )
C-------------------------------------------------------------------------------
```

Argument	Format	Description
IIN	Integer read only scalar	Input file unit (Starter input file) on which the data are read.
IOUT	Integer read only scalar	Output file unit (Starter listing file).
IUPARAM(*)	Integer array	Parameters to be transferred to RADIOSS.
NUMNOD	Integer scale	Number of nodes (defined by /NODE option).
ITAB(NUMNOD)	Integer array	An array of size NUMNOD. This defines the node ID versus RADIOSS internal node number.
X(3,NUMNOD)	Float array	Nodal coordinates.
V(3,NUMNOD)	Float array	Nodal initial velocities.
VR(3,NUMNOD)	Float array	Nodal initial rotational velocities.
MASS(NUMNOD)	Float array	Nodal mass.
INER(NUMNOD)	Float array	Nodal spherical inertia.
NUVAR	Integer scalar	Size of global user's float array. Memory size available for float.
NUVARI	Integer scale	Size of global user's integer array. Memory size available for integer.

1.2 Starter Subroutine USERWIS

This subroutine is reads input data. You can specify the number of cards and their format.

The argument list of USERWIS and its individual arguments and descriptions are as follows:

```
C--------------------------------------------------------------------------------

      SUBROUTINE USERWIS(IIN    ,IOUT   ,NUMNOD  ,ITAB    ,

     .                   X       ,V       ,VR       ,MASS  ,INER    ,

     .                   NUVAR  ,NUVARI ,UVAR    ,IUVAR  )

C--------------------------------------------------------------------------------
```

Argument	Format	Description
IIN	Integer read only scalar	Input file unit (Starter input file) on which the data are read.
IOUT	Integer read only scalar	Output file unit (Starter listing file).
NUMNOD	Integer scalar	Number of nodes (defined with /NODE option).
ITAB(NUMNOD)	Integer array	An array of size NUMNOD. This defines the node ID versus RADIOSS internal node number.
X(3,NUMNOD)	Float array	Nodal coordinates.
V(3,NUMNOD)	Float array	Nodal initial coordinates.
VR(3,NUMNOD)	Float array	Nodal initial rotational velocities.
Mass(NUMNOD)	Float array	Nodal mass.
INTER(NUMNOD)	Float array	Nodal spherical inertia.
NUVAR	Integer scalar	Needed size of global user float array.
NUVARI	Integer scalar	Needed size of global user integer array.
UVAR(MAXNUVAR)	Float array	An array of size MAXNUVAR in RADIOSS Starter. This array is transmitted versus restart file to RADIOSS Engine, where it has a size of NUVAR.
IUVAR(MAXNUVARI)	Integer array	An array of size MAXNUVARI in RADIOSS Starter. This array is transmitted versus restart file to RADIOSS Engine, where it has a size of NUVARI.

1.3 Engine Subroutine USERWI

This subroutine calculates the internal forces and moments versus the velocity, old forces and moments, and specified variables and parameters.

The argument list of USERWI and its individual arguments and descriptions are as follows:

```
C-------------------------------------------------------------------------------
      SUBROUTINE USERWI(
     1  IIN   ,IOUT   ,NUVAR  ,NUVARI ,NUMNOD ,NCYCLE  ,
     2  LENWA ,IUVAR  ,ITAB   ,
     3  TT    ,DT1    ,DT2    ,USREINT,EXWORK  ,
     4  UVAR  ,D      ,X      ,V      ,VR      ,MASS   ,
     5  INER  ,STIFN  ,STIFR  ,A      ,AR      ,WA     )
C-------------------------------------------------------------------------------
```

Argument	Format	Description
IIN	Integer read only scalar	Input file unit (Engine file).
IOUT	Integer read only scalar	Output file unit (listing file).
NUVAR	Integer read only scalar	Size of user float array.
NUVARI	Integer read only scalar	Size of user integer array.
NUMNOD	Integer read only scalar	Number of nodes.
NCYCLE	Integer read only scalar	Current cycle number.
IUVAR(NUVARI)	Integer read write array	An array of size NUVARI. This array contains user data and variables and is saved on restart file.
ITAB(NUMNOD)	Integer read only array	An array of size NUMNOD. This array defines the node ID versus RADIOSS internal node number.
TT	Float read only scalar	Current time.
DT1	Float read only scalar	Current time step.
DT2	Float write only scalar	User stability time step. With element time step formulation, DT2 has to be computed at each cycle.
USREINT	Float read write scalar	User window internal energy.
EXWORK	Float read write scalar	External work. Variable can be increased.
UVAR(NUVAR)	Float read-write array	An array of size NUVAR. This array contains user data and variables and is saved on restart file.
D(3,NUMNOD)	Float read only array	Nodal displacements.
X(3,NUMNOD)	Float read only array	Nodal coordinates.
V(3,NUMNOD)	Float read only array	Nodal initial velocities.
VR(3,NUMNOD)	Float read only array	Nodal mass.
INER(NUMNOD)	Float read only array	Nodal spherical inertia.
STIFEN(NUMNOD)	Float read write array	Nodal stiffness for nodal time step formulation. The added user stiffness has to be added to STIFEN.
STIFR(NUMNOD)	Float read write array	Nodal rotational stiffness for nodal time step formulation. The added user stiffness has to be added to STIFR.
A(3,NUMNOD)	Float read write array	Nodal forces. User forces have to be added to A.

Argument	Format	Description
AR(3,NUMNOD)	Float read write array	Nodal moments. User moments have to be added to AR.

STIFN, STIFR are used by RADIOSS to compute the nodal or the element time step. DT2 is needed to compute element.

1.4 Example of User Window

1.4.1 User's Subroutine USERWIS_INI

```
C-----------------------------------------------------------------
C    This subroutine initializes the global user's window
C-----------------------------------------------------------------
      SUBROUTINE USERWIS_INI(
     .          IIN    ,IOUT   ,IUPARAM ,NUMNOD ,ITAB    ,
     .          X      ,V      ,VR      ,MASS    ,INER    ,
     .          NUVAR  ,NUVARI )
C--------------------------------------------------
C  I m p l i c i t   T y p e s
C--------------------------------------------------
       IMPLICIT NONE
C--------------------------------------------------
C    The user's data can be stored in UVAR for floating points and
C    IUVAR for integers
C--------------------------------------------------
C  D u m m y   A r g u m e n t s
C--------------------------------------------------
      INTEGER, INTENT (IN)  ::  IIN   ,IOUT   ,NUMNOD
      INTEGER, INTENT (IN)  ::  ITAB(NUMNOD)
      INTEGER, INTENT (OUT) ::  NUVAR ,NUVARI
      INTEGER, INTENT (OUT) ::  IUPARAM(100)
      DOUBLE PRECISION , INTENT (IN)  ::
     .   X(3,NUMNOD) ,V(3,NUMNOD) ,VR(3,NUMNOD) ,MASS(NUMNOD) ,
     .   INER(NUMNOD)
C
      RETURN
      END
```

1.4.2 Starter User's Subroutine USERWIS

```
C-----------------------------------------------------------------
C    This subroutine initializes the global user's window
C-----------------------------------------------------------------
      SUBROUTINE USERWIS(
     .            IIN    ,IOUT   ,NUMNOD   ,ITAB    ,
     .            X      ,V      ,VR       ,MASS    ,INER    ,
     .            NUVAR  ,NUVARI ,UVAR     ,IUVAR   )
C--------------------------------------------------
C  I m p l i c i t   T y p e s
```

```
C-----------------------------------------------
      IMPLICIT NONE
C-----------------------------------------------
C    The user's data can be stored in UVAR for floating points and
C    IUVAR for integers
C-----------------------------------------------
C  D u m m y   A r g u m e n t s
C-----------------------------------------------
C----------+---------+---+---+------------------------------------
C VAR      | SIZE    |TYP| RW| DEFINITION
C----------+---------+---+---+------------------------------------
C IIN      | 1       | I | R | INPUT FILE UNIT (D00 file)
C IOUT     | 1       | I | R | OUTPUT FILE UNIT (L00 file)
C NUVAR    | 1       | I | R | SIZE OF USER REAL ARRAY
C NUVARI   | 1       | I | R | SIZE OF USER INTEGER ARRAY
C NUMNOD   | 1       | I | R | NUMBER OF NODES
C----------+---------+---+---+------------------------------------
C IUVAR    | NUVARI  | I | W | USER INTEGER ARRAY
C----------+---------+---+---+------------------------------------
C UVAR     | NUVAR   | F | W | USER D PRECISION ARRAY
C----------+---------+---+---+------------------------------------
C ITAB     | NUMNOD  | I | R | USER NODE ID
C----------+---------+---+---+------------------------------------
C X        |3,NUMNOD | F | R | X,Y,Z COORDINATES
C V        |3,NUMNOD | F | R | X,Y,Z VELOCITIES
C VR       |3,NUMNOD | F | R | XX,YY,ZZ ROTATIONAL VELOCITIES
C----------+---------+---+---+------------------------------------
C MASS     | NUMNOD  | F |R/W| NODAL MASS
C INER     | NUMNOD  | F |R/W| NODAL SHERICAL INERTIA
C----------+---------+---+---+------------------------------------
C
C    This subroutine initializes the global user's window
C    and fills up the user variable buffers :
C          UVAR for floating points and
C          IUVAR for integers
C-----------------------------------------------
C  D u m m y   A r g u m e n t s
C-----------------------------------------------
      INTEGER, INTENT (IN) :: IIN   ,IOUT  ,NUMNOD, NUVAR ,NUVARI
      INTEGER, INTENT (IN) :: ITAB(NUMNOD)
      DOUBLE PRECISION , INTENT (IN) ::
     .  X(3,NUMNOD) ,V(3,NUMNOD),VR(3,NUMNOD),MASS(NUMNOD),INER(NUMNOD)
```

```
        INTEGER          , DIMENSION(NUVARI) ,INTENT(OUT) ::  IUVAR
        DOUBLE PRECISION , DIMENSION(NUVAR)  ,INTENT(OUT) :: UVAR
   C
      RETURN
      END
```

1.4.3 Engine User's Subroutine USERWI

```
      C-------------------------------------------------------------------
      C    Global user window subroutine
      C-------------------------------------------------------------------
       SUBROUTINE USERWI(
      1   IIN   ,IOUT   ,NUVAR  ,NUVARI ,NUMNOD ,NCYCLE  ,
      2   LENWA ,IUVAR  ,ITAB  ,
      3   TT    ,DT1    ,DT2    ,USREINT,EXWORK  ,
      4   UVAR  ,D      ,X      ,V      ,VR      ,MASS  ,
      5   INER  ,STIFN  ,STIFR ,A      ,AR      ,WA    )
      C
      C----------------------------------------------
      C  I m p l i c i t   T y p e s
      C----------------------------------------------
      C#include     "implicit_f.inc"
      C----------------------------------------------------------
      C  D u m m y   A r g u m e n t s   a n d   F u n c t i o n
      C----------------------------------------------------------
       INTEGER
      1   IIN    ,IOUT   ,NUVAR   ,NUVARI,NUMNOD,NCYCLE  ,LENWA,
      2   IUVAR(NUVARI)  ,ITAB(NUMNOD)
       DOUBLE PRECISION
      1   TT     ,DT1    ,DT2     ,USREINT,EXWORK  ,
      2   UVAR(NUVAR)  ,D(3,NUMNOD)  ,X(3,NUMNOD)  ,V(3,NUMNOD)  ,
      3   VR(3,NUMNOD) ,A(3,NUMNOD)  ,AR(3,NUMNOD)  ,MASS(NUMNOD)  ,
      4   INER(NUMNOD) ,STIFN(NUMNOD)  ,STIFR(NUMNOD),WA(LENWA)
      C==================================================================
      C
      C    EXAMPLE :
      C
      C==================================================================
      C----------------------------------------------
      C  L o c a l   V a r i a b l e s
      C----------------------------------------------
      C-----------------------------
      RETURN
      END
```