File Formats Reference Guide

Universal Dataset Number 2414

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Universal Dataset
Number: 2414
Name:   Analysis Data
Status: Current
Owner:  Simulation
Revision Date: 3-OCT-1994
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Record 1:        FORMAT(1I10)
                 Field 1       -- Analysis dataset label

Record 2:        FORMAT(40A2)
                 Field 1       -- Analysis dataset name

Record 3:        FORMAT (1I10)
                 Field 1:      -- Dataset location
                                   1:    Data at nodes
                                   2:    Data on elements
                                   3:    Data at nodes on elements
                                   5:    Data at points
                                   6:    Data on elements at nodes

Record 4:        FORMAT (40A2)
                 Field 1:      -- ID line 1

Record 5:        FORMAT (40A2)
                 Field 1:      -- ID line 2

Record 6:        FORMAT (40A2)
                 Field 1:      -- ID line 3

Record 7:        FORMAT (40A2)
                 Field 1:      -- ID line 4

Record 8:        FORMAT (40A2)
                 Field 1:      -- ID line 5

Record 9:        FORMAT (6I10)
                 Field 1:      -- Model type
                                   0:   Unknown
                                   1:   Structural
                                   2:   Heat transfer
                                   3:   Fluid flow
                 Field 2:      -- Analysis type
                                   0:   Unknown
                                   1:   Static
                                   2:   Normal mode
                                   3:   Complex eigenvalue first order
                                   4:   Transient
                                   5:   Frequency response
                                   6:   Buckling
                                   7:   Complex eigenvalue second order
                                   9:   Static non-linear
                                  10:   Craig-Bampton constraint modes
                                  11:   Equivalent attachment modes
                                  12:   Effective mass modes
                                  13:   Effective mass matrix
                                  14:   Effective mass matrix
                 Field 3:      -- Data characteristic
                                   0:   Unknown
```

```
                    1:   Scalar
                    2:   3 DOF global translation vector
                    3:   6 DOF global translation & rotation
                         vector
                    4:   Symmetric global tensor
                    6:   Stress resultants
Field 4:      -- Result type
                    2:Stress
                    3:Strain
                    4:Element Force
                    5:Temperature
                    6:Heat Flux
                    7:Strain Energy
                    8:Displacement
                    9:Reaction Force
                   10:Kinetic Energy
                   11:Velocity
                   12:Acceleration
                   13:Strain Energy Density
                   14:Kinetic Energy Density
                   15:Hydrostatic Pressure
                   16:Heat Gradient
                   17:Code Check Value
                   18:Coefficient of Pressure
                   19:Ply Stress
                   20:Ply Strain
                   21:Failure Index for Ply
                   22:Failure Index for Bonding
                   23:Reaction Heat Flow
                   24:Stress Error Density
                   25:Stress Variation
                   27:Element Stress Resultant
                   28:Length
                   29:Area
                   30:Volume
                   31:Mass
                   32:Constraint Force
                   34:Plastic Strain
                   35:Creep Strain
                   36:Strain Energy Error Norm
                   37:Dynamic Stress At Nodes
                   38:Heat Transfer Coefficient
                   39:Temperature Gradient
                   40:Kinetic Energy Dissipation Rate
                   41:Strain Energy Error
                   42:Mass Flow
                   43:Mass Flux
                   44:Heat Flow
                   45:View Factor
                   46:Heat Load
                   47:Stress Component
                   48:Green Strain
                   49:Contact Forces
                   50:Contact Pressure
                   51:Contact Stress
                   52:Contact Friction Stress
                   53:Velocity Component
                   54:Heat Flux Component
                   55:Infrared Heat Flux
                   56:Diffuse Solar Heat Flux
                   57:Collimated Solar Heat Flux
                   58:Safety Factor
                   59:Fatigue Damage
                   60:Fatigue Damage With Direction
                   61:Fatigue Life
                   62:Quality Index
                   74:Nodal Point Forces
```

```
 94:Unknown Scalar
 95:Unknown 3DOF Vector
 96:Unknown 6DOF Vector
 97:Unknown Symmetric Tensor
 98:Unknown General Tensor
 99:Unknown Stress Resultant
101:Gap Thickness
102:Solid Layer (+ surface)
103:Solid Layer (- surface)
104:Total Solid Layer
105:Flow Vector at Fill
106:Bulk Flow Vector
107:Core Displacement
108:Layered Shear Strain Rate
109:Shear Stress
110:Heat Flux (+ surface)
111:Heat Flux (- surface)
112:Layered Temperature
113:Bulk Temperature
114:Peak Temperature
115:Temperature at Fill
116:Mass Density
117:Pressure
118:Volumetric Skrinkage
119:Filling Time
120:Ejection Time
121:No-flow Time
122:Weld Line Meeting Angle
123:Weld Line Underflow
124:Original Runner Diameter
125:Optimized Runner Diameter
126:Change in Runner Diameter
127:Averaged Layered Cure
128:Layered Cure
129:Cure Rate
130:Cure Time
131:Induction Time
132:Temperature at Cure
133:Percent Gelation
134:Part Heat Flux (+ surface)
135:Part Heat Flux (- surface)
136:Part-Wall Temperature (+ surface)
137:Part-Wall Temperature (- surface)
138:Part Ejection Time
139:Part Peak Temperature
140:Part Average Temperature
141:Parting Temperature (+ surface)
142:Parting Temperature (- surface)
143:Parting Heat Flux (- surface)
144:Parting Heat Flux (+ surface)
145:Wall Temperature Convergence
146:Wall Temperature (- surface)
147:Wall Temperature (+ surface)
148:Line Heat Flux
149:Line Pressure
150:Reynold's Number
151:Line Film Coefficient
152:Line Temperature
153:Line Bulk Temperature
154:Mold Temperature
155:Mold Heat Flux
156:Rod Heater Temperature
157:Rod Heater Flux
158:Original Line Diameter
159:Optimized Line Diameter
160:Change in Line Diameter
161:Air Traps
```

```
                                 162:Weld Lines
                                 163:Injection Growth
                                 164:Temp Diff (Celcius)
                                 165:Shear Rate
                                 166:Viscosity
                                 167:Percentage
                                 168:Time
                                 169:Flow Direction
                                 170:Speed
                                 171:Flow Rate
                                 172:Thickness Ratio
                                 301:Sound Pressure
                                 302:Sound Power
                                 303:Sound Intensity
                                 304:Sound Energy
                                 305:Sound Energy Density
                                >1000:  User defined result type
                  Field 5:      -- Data type
                                    1:   Integer
                                    2:   Single precision floating point
                                    4:   Double precision floating point
                                    5:   Single precision complex
                                    6:   Double precision complex
                  Field 6:      -- Number of data values for the data
                                   component (NVALDC)

Record 10:        FORMAT (8I10)
                  Field 1:      -- Integer analysis type specific data (1-8)

Record 11:        FORMAT (8I10)
                  Field 1:      -- Integer analysis type specific data (9,10)

Record 12:        FORMAT (6E13.5)
                  Field 1:      -- Real analysis type specific data (1-6)

Record 13:        FORMAT (6E13.5)
                  Field 1:      -- Real analysis type specific data (7-12)

Note: See chart below for specific analysis type information.


Dataset class: Data at nodes

Record 14:        FORMAT (I10)
                  Field 1:      -- Node number

Record 15:        FORMAT (6E13.5)
                  Fields 1-N:   -- Data at this node (NDVAL real or complex
                                                      values)

                  Note: Records 14 and 15 are repeated for each node.


Dataset class: Data at elements

Record 14:        FORMAT (2I10)
                  Field 1:      -- Element number
                  Field 2:      -- Number Of data values For this element(NDVAL)

Record 15:        FORMAT (6E13.5)
                  Fields 1-N:   -- Data on element(NDVAL Real Or Complex Values)


                  Note: Records 14 and 15 are repeated for all elements.


Dataset class: Data at nodes on elements
```

```
RECORD 14:       FORMAT (4I10)
                 Field 1:      -- Element number
                 Field 2:      -- Data expansion code (IEXP)
                                  1: Data present for all nodes
                                  2: Data present for only 1st node -All other
                                     nodes the same.
                 Field 3:      -- Number of nodes on elements (NLOCS)
                 Field 4:      -- Number of data values per node (NVLOC)

RECORD 15:       FORMAT (6E13.5)

                 Fields 1-N:   -- Data Values At Node 1 (NVLOC Real Or
                                  Complex Values)

                 Note:  Records 14 And 15 Are repeated For each Element.

                        For Iexp = 1 Record 15 Is repeated NLOCS Times

                        For Iexp = 2 Record 15 appears once

Dataset class: Data at points

RECORD 14:       FORMAT (5I10)
                 Field 1:      -- Element number
                 Field 2:      -- Data expansion code (IEXP)
                                  1: Data present for all points
                                  2: Data present for only 1st point -All other
                                     points the same.
                 Field 3:      -- Number of points on elements (NLOCS)
                 Field 4:      -- Number of data values per point (NVLOC)
                 Field 5:      -- Element order

RECORD 15:       FORMAT (6E13.5)

                 Fields 1-N:   -- Data Values At point 1 (NVLOC Real Or
                                  Complex Values)

                 Note:  Records 14 And 15 Are repeated For each Element.

                        For Iexp = 1 Record 15 Is repeated NLOC Times

                        For Iexp = 2 Record 15 appears once


Dataset class: Data on elements at nodes

RECORD 14:       FORMAT (2I10)
                 Field 1:      -- Node number
                 Field 2:      -- Number of entries for this node (NLOCS)

RECORD 15:       FORMAT (I10)
                 Field 1:      -- Entry identifier
                                  >0 = Element number
                                   0 = Reaction forces
                                  -1 = Applied loading at node
                                  -2 = MPC/Couple forces

RECORD 16:       FORMAT (6E13.5)

                 Fields 1-N:   -- Data Values At Node (6 Real Or
                                  Complex Values)

                 Note:  Records 14 through 16 Are repeated For each Node.
```

Notes:

1. ID lines may not be blank. If no information is required, the word "NONE" must appear in columns 1-4.

2. The data is store in "node-layer-data charateristic" format.

```
 Loc1 layer1 component1, Loc1 layer1 component2, ...
 Loc1 layer1 componentN, Loc1 layer2 component1, ...
 Loc1 Layer2 componentN, ...Loc1 layerN componentN
 Loc2 layer1 component1, ...Loc2 layerN componentN
 LocN layer1 component1, ...LocN layerN componentN
```

3. For complex data there Will Be 2*NDVAL data items. The order is real part for value 1, imaginary part for value 1, real part for value 2, imaginary part for value 2, etc.

4. The order of values for various data characteristics is:

```
3 DOF Global Vector: X, Y, Z
6 DOF Global Vector: X, Y, Z, Rx, Ry, Rz
Symmetric Global Tensor: Sxx, Sxy, Syy,
                         Sxz, Syz, Szz

Shell and Plate Element Resultant: Fx, Fy, Fxy,
                                   Mx, My, Mxy,
                                   Vx, Vy
```

5. ID line 1 always appears on plots in output display.

6. If result type is an "UNKNOWN" type, id line 2 is displayed as data type in output display.

7. Data Characteristic values (Record 9, Field 3) imply the following values Of NDVALDC (Record 9, Field 6)

```
      Scalar:                   1
      3 DOF Global Vector:      3
      6 DOF Global Vector:      6
      Symmetric Global Tensor:  6
      General Global Tensor:    9
      Shell and Plate Resultant:8
```

   Since this value can also be derived from the Results Type (Record 9, Field 4), this is redundant data, and should be kept consistent. Some data was kept for compatibility with older files.

8. No entry is NOT the same as a 0. entry: all 0s must be specified.

9. A direct result of 8 is that if no records 14 and 15 appear for a node or element, this entity has no data and will not be contoured, etc.

10. Dataloaders use the following id line convention:

```
 1.   (80A1) MODEL IDENTIFICATION
 2.   (80A1) RUN IDENTIFICATION
 3.   (80A1) RUN DATE/TIME
 4.   (80A1) LOAD CASE NAME
 For static:

 5.   (17H LOAD CASE NUMBER;, I10)
```

```
                        For normal mode:

                        5.   (10H MODE SAME, I10, 10H FREQUENCY, E13.5)

                    11. For situations with reduced # DOF'S, use 6 DOF
                        translation and rotation with unused values = 0.

                    12. The integer associated data "number retained" will
                        =0 unless the result set is created by sorting for
                        extremes.  The maximum number of values to retain is 6.

          Specifed values:
           NDVAL  - Number of data values for the element.
           NLOCS  - Number of location on the element data is stored for.
           NVALDC - Number of values for the data component.

          Derived values:
           NLAY   - Number of location through the thickness data is stored for
                    =  NDVAL / ( NLOCS * NDVALC)
           NVLOC  - Number of values per location.
                    =  NLAY * NVALDC

          The following is always true:
          NDVAL =  NLOCS * NLAY * NVALDC

Dataset class: Data at nodes

                    1.  NLOCS = 1
                        NLAY  = 1

                        NDVAL = NVALDC

                    2.  Typical fortran I/O statements for the data
                        sections are:

                              READ(LUN,1000)NUM
                              WRITE
                         1000 FORMAT (I10)
                              READ(LUN,1010) (VAL(I),I=1,NDVAL)
                              WRITE
                         1010 FORMAT (6E13.5)

                              Where: VAL is real or complex data array
                                     NUM is element number

Dataset class: Data at elements


                    1.  Data on 2D type elements may have multiple values
                        through the element thickness.  In these cases:
                           NLOCS =1
                             NLAY  =Number of layers of data through the thickness.

                          NDVAL = NLAY * NVALDC

                        For solid elements:
                          NLOCS = 1
                             NLAY  = 1

                          NDVAL = NVALDC

                        The order of the nodes defines an outward normal which
                        specifies the order from position 1 to NPOS.

                    2.  Maximum Value For NVALDC Is 9.
                        No Maximum Value For NDVAL.
                        No Maximum Value For NLAY.
```

3. Typical fortran I/O statements for the data sections are:

```
      READ (LUN, 1000) NUM, NDVAL
      WRITE
 1000 FORMAT (2I10)
      READ (LUN, 1010) (VAL(I),I=1,NDVAL)
      WRITE
 1010 FORMAT (6E13.5)
```

Where: VAL is real or complex data array
NUM is element number

Dataset class: Data at nodes on elements

1. Data on 2D type elements may have multiple values through the element thickness. In these cases:
   NLOCS =Number of nodes for the element.
   NLAY =Number of layers of data through the thickness.

   NDVAL = NLOCS * NLAY * NVALDC

   For solid elements:
   NLOCS = Number of nodes for the element.
   NLAY = 1

   NDVAL = NLOCS * NVALDC

   The order of the nodes defines an outward normal which specifies the order from position 1 to NPOS.

2. Maximum Value For NVALDC Is 9.
   No Maximum Value For NDVAL.
   No Maximum Value For NLAY.

3. Typical Fortran I/O statements for the data sections are:

```
      READ (LUN,1000) NUM, IEXP, NLOCS, NVLOC
      WRITE
 1000 FORMAT (4I10)
C
C       Process Expansion Code 1
C
      IF (IEXP.NE.1) GO TO 20
      NSTRT = 1
      DO 10 I=1, NLOCS
        NSTOP = NSTRT + NVLOC - 1
        READ (LUN,1010) (VAL(J),J=NSTRT,STOP)
        WRITE
 1010   FORMAT (6E13.5)
        NSTRT = NSTRT + NVLOC
 10   CONTINUE
      GO TO 50
C
C       PROCESS EXPANSION CODE 2
C
 20   READ (LUN,1010) (VAL(I),I=1,NVLOC)
      NOFF = 0
      DO 40 I=1,NLOCS
        NOFF = NOFF +NVLOC
        DO 30 J=1, NVLOC
          VAL (NOFF+J) = VAL(J)
 30     CONTINUE
 40   CONTINUE
C
 50   NDVAL = NVLOC*NLOCS
```

```
                    Where:    NUM is element number.
                              IEXP is the element expansion code
                              VAL is real or complex data array.
```

Dataset class: Data at points

1. Only Tetrahedral elements will be supported.

2. For solid elements:
   NLOCS = Number of points on the element data is stored for. Determined from the element type and order.
   NLAY = 1

   NDVAL = NLOCS * NVALDC

3. Maximum Value For NVALDC Is 9.
   No Maximum Value For NDVAL.

4. The element order is equal to the P-order of the element

5. The number of points per element is calculated from the element order as follows:

   Number_of_Points = sum(i= 1 to P-Order+1)
   [sum(j = 1 to i)[1 + i - j))]]

6. Typical Fortran I/O statements for the data sections are:

```
      READ (LUN,1000) NUM, IEXP, NLOCS, NVLOC, IORDER
      WRITE
 1000 FORMAT (4I10)
                .
                .
                .
   (See 3. for Data at Nodes on Elements)
```

Analysis Type

	Unknown	Static	Normal Modes	Complex Eigen 1	Transient	Freq Response	Buckling	Complex Eigen 2	Static Linear
Design set ID	X	X	X	X	X	X	X	X	X

	Iteration number		X	X					
	Solution set ID	X	X	X	X	X	X	X	X	X
I										
N	Boundary condition	X	X	X	X	X	X	X	X	X
T										
E	Load set		X		X	X	X	X	X	
G										
E	Mode number			X	X			X	X	
R										
	Time step number					X				X
	Frequency number						X			
	Creation option	X	X	X	X	X	X	X	X	X
	Number retained	X	X	X	X	X	X	X	X	X
	Time					X				X
	Frequency			X			X			
	Eigenvalue							X		
	Modal Mass			X						
	Viscous damping ratio			X						
	Hysteretic damping ratio			X						
R	Real part eigenvalue				X				X	
E										
A	Imaginary part eingenvalue				X				X	
L										
	Real part of modal A				X					
	Real part of mass								X	
	Imaginary part of modal A				X					
	Imaginary part of mas								X	
	Real part of modal B				X					
	Real part of stiffnes								X	
	Imaginary part of modal B				X					
	Imaginary part of stiffness								X	
