

LS-Reader Tutorial

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Introduction

This document describes the application functions interface of LS-Reader using C++, Python and C.

The LS-Reader is designed to read LS-DYNA results and it supports C, C++ and Python languages. It supports both Windows(vs2010, vs2015, vs2017, vs2019) and Linux(GCC \geq 4.1.2). Because of the simplicity of the LS-Reader, using the libraries is very convenient

Python

D3plotReader

API Functions *(Recommended)*

```
class D3plotReader():
```

```
    def __init__(self, path):
```

```
        pass
```

❖ Purpose: Constructor.

❖ Input: path: d3plot name.

❖ Return: D3plotReader object.

Example: dr = D3plotReader("d3plot/file/path")

```
def get_data(self, type, param):
```

```
    pass
```

❖ Purpose: Extract data.

❖ Input: type: type - enum the data variables' name in d3plot.

param: structure of description which is the advance setting for getting special data in d3plot.

❖ Return: data.

Example:

```
dr = D3plotReader("d3plot/file/path")
```

```
p = D3P_Parameter()
```

```
p.ist = 11
```

```
p.ipt = 0
```

```
shell_stress = dr.get_data(DataType.D3P_SHELL_STRESS, p)
```

Or

```
dr = D3plotReader("d3plot/file/path")

shell_stress = dr.get_data(
    DataType.D3P_SHELL_STRESS, ist=11, ipt=0
)
```

API Functions *(Deprecated)*

```
class D3plotReader():
```

```
    def __init__(self, path):
```

```
        pass
```

❖ Purpose: Constructor.

❖ Input: path: d3plot name.

❖ Return: D3plotReader object.

Example: `dr = D3plotReader("d3plot/file/path")`

```
def GetDataInt(self, type, param):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get an integer value.

❖ Input: type - enum the data variables' name in d3plot.

Param - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: int

```
def GetDataFloat(self, type, param):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get a float value.

❖ Input: type - enum the data variables' name in d3plot.

param - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: float.

```
def GetDataString(self, type, param):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get a string value.

❖ Input: `type` - enum the data variables' name in d3plot.

`param` - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: string.

```
def GetDataIntArray(self, type, param):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get a int array.

❖ Input: `type` - enum the data variables' name in d3plot.

`param` - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: int array.

```
def GetDataFloatArray(self, type, param):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get a float array.

❖ Input: `type` - enum the data variables' name in d3plot.

param - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: float array.

```
def GetDataVectorArray(self, type, param):  
    pass
```

Deprecated. Use the get_data(...) instead.

❖ Purpose: Get a vector array.

❖ Input: type - enum the data variables' name in d3plot.

param - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: vector array.

```
def GetDataTensorArray(self, type, param):  
    pass
```

Deprecated. Use the get_data(...) instead.

❖ Purpose: Get a tensor array.

❖ Input: type - enum the data variables' name in d3plot.

param - structure of description which is the advance setting for getting special data in d3plot.

❖ Return: tensor array.

```
def GetDataSolidArray(self):  
    pass
```

Deprecated. Use the get_data(...) instead.

❖ Purpose: Get solid elements array.

❖ Return: solid elements array.

```
def GetDataTshellArray(self):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get tshell elements array.

❖ Return: tshell elements array.

```
def GetDataBeamArray(self):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get beam elements array.

❖ Return: beam elements array.

```
def GetDataShellArray(self):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get shell elements array.

❖ Return: shell elements array.

```
def GetDataSphArray(self):
```

```
    pass
```

Deprecated. Use the `get_data(...)` instead.

❖ Purpose: Get sph elements array.

❖ Return: sph elements array.

D3P_Parameter

parameter to call D3plotReader::get_data*, only specific those member variables you are interested, otherwise, ignore this.

```
class D3P_Parameter:
    def __init__(self):
        self.ist = -1
        self.ipt = -1
        self.ipart = -1
        self.ipart_user = -1
        self.i_rigid_wall = -1
        self.ides = -1
        self.ihv = -1
        self.index_multisolver = -1
        self.id_var_multisolver = -1
        self.iuser = -1
        self.var_name = ""
```

1. **ist**: Specify the state number, starting from 0, as follows:

```
shell_thickness = dr.get_data(DataType.D3P_SHELL_THICKNESS, ist=11)
```

Or

```
p = D3P_Parameter()
```

```
p.ist = 11
```

```
shell_thickness = dr.get_data(DataType.D3P_SHELL_THICKNESS, p)
```

2. **ipt**: Specify the integration point, ranging in [0, MAXINT), as follows:

```
shell_stress = dr.get_data(DataType.D3P_SHELL_STRESS, ist=11, ipt=0)
```

Or

```
p = D3P_Parameter()
```

- ```
p.ist = 11
p.ipt = 0
shell_stress = dr.get_data(DataType.D3P_SHELL_STRESS, p)
```
3. **ipart:** Specify the index of part, starting from 0, as follows:
 

```
part_name = dr.get_data(DataType.D3P_PART_NAME, ipart=0)
Or
p = D3P_Parameter()
p.ipart = 0
part_name = dr.get_data(DataType.D3P_PART_NAME, p)
```
  4. **ipart\_user:** Specify the user id of part, as follows:
 

```
num_shells = dr.get_data(DataType.D3P_NUM_SHELL, ipart_user=3)
```
  5. **i\_rigid\_wall:** Specify the index of rigid wall, starting from 0, as follows:
 

```
r_wall_f = dr.get_data(
 DataType.D3P_RIGID_WALL_FORCE, ist=11, i_rigid_wall=0
)
Or
p = D3P_Parameter()
p.ist = 11
p.i_rigid_wall = 0
r_wall_f = dr.get_data(DataType.D3P_RIGID_WALL_FORCE, p)
```
  6. **ides:** Specify the index of the des data, starting from 0, as follows:
 

```
num_des = dr.get_data(DataType.D3P_NUM_DES_PART_IN_GEOM, ides=0)
Or
p = D3P_Parameter()
p.ides = 0
num_des = dr.get_data(DataType.D3P_NUM_DES_PART_IN_GEOM, p)
```
  7. **ihv:** Specify the index of history variables, starting from 0, as follows:

```
solid_hsvar = dr.get_data(
 DataType.D3P_SOLID_HISTORY_VAR, ist=11, ipt=0, ihv=5
)
```

Or

```
p = D3P_Parameter()
p.ist = 11
p.ipt = 0
p.ihv = 5

solid_hsvar = dr.get_data(DataType.D3P_SOLID_HISTORY_VAR, p)
```

8. **index\_multisolver:** Specify the index of the multisolver domain, start from 0 and default is 0 also:

```
ms_id = dr.get_data(DataType.D3P_MS_DOMAIN_ID, index_multisolver=0)
```

Or

```
p = D3P_Parameter()
p.index_multisolver = 0

ms_id = dr.get_data(DataType.D3P_MS_DOMAIN_ID, p)
```

9. **id\_var\_multisolver:** Specify the index of the multisolver var, start from 0 and default is 0 also:

```
ms_varn = dr.get_data(DataType.D3P_MS_VAR_NAME, id_var_multisolver=0)
```

Or

```
p = D3P_Parameter()
p.id_var_multisolver = 0

ms_varn = dr.get_data(DataType.D3P_MS_VAR_NAME, p)
```

10. **iuser:** Specify the index of the user id:

```
internal_id = dr.get_data(DataType.D3P_SHELL_INTERNAL_ID, iuser=354)
```

11. **var\_name:** Specify name of output variables, currently used by DES and CPM data, default is empty

```
cpm_geodt = dr.get_data(DataType.D3P_CPM_GEOM_DATA, var_name='cpm1')
```

Or

```
p = D3P_Parameter()
```

```
p.var_name = 'cpm1'
```

```
cpm_geodt = dr.get_data(DataType.D3P_CPM_GEOM_DATA, p)
```

---

## DataType

```
class D3P_Vector():
```

```
 def x(self):
```

```
 pass
```

```
 def y(self):
```

```
 pass
```

```
 def z(self):
```

```
 pass
```

```
class D3P_VectorDouble():
```

```
 def x(self):
```

```
 pass
```

```
 def y(self):
```

```
 pass
```

```
 def z(self):
```

```
 pass
```

```
class D3P_Tensor():
```

```
 def x(self):
```

```
 pass
```

```
 def y(self):
```

```
 pass
```

```
 def z(self):
```

```
 pass
```

```
 def xy(self):
```

```
 pass
```

```

def yz(self):
 pass

def zx(self):
 pass

class D3P_Solid():

 # return the value of nodal index(start from 0) plus one
 def node(self, index):
 pass

 def mat(self):
 pass

class D3P_Tshell():

 # return the value of nodal index(start from 0) plus one
 def node(self, index):
 pass

 def mat(self):
 pass

class D3P_Beam():

 # return the value of nodal index(start from 0) plus one
 def node(self, index):
 pass

 def mat(self):
 pass

class D3P_Shell():

```

```

 # return the value of nodal index(start from 0) plus one
 def node(self, index):
 pass

 def mat(self):
 pass

class D3P_Sph():
 def id(self):
 pass

 def mat(self):
 pass

class D3P_Var():
 def type(self):
 pass

 def name(self):
 pass

class D3P_Des():
 def id(self):
 pass

 def mat(self):
 pass

 def radius(self):
 pass

 def mass(self):
 pass

```

```
def inertia(self):
 pass
```

---

---

| name                         | conversion | length         | parameters           |
|------------------------------|------------|----------------|----------------------|
| D3P_NUM_STATES               | int        | 1              | ignore               |
| D3P_TIMES                    | float      | D3P_NUM_STATES | ignore               |
| D3P_TITLE                    | Char       |                | ignore               |
| Global                       |            |                |                      |
| D3P_GLOBAL_KINETIC_ENERGY    | float      | 1              | ist                  |
| D3P_GLOBAL_INTERNAL_ENERGY   | float      | 1              | ist                  |
| D3P_GLOBAL_TOTAL_ENERGY      | float      | 1              | ist                  |
| D3P_GLOBAL_VELOCITY          | D3P_Vector | 1              | ist                  |
| Part                         |            |                |                      |
| D3P_NUM_PARTS                | int        | 1              | ignore               |
| D3P_PART_IDS                 | int        | D3P_NUM_PARTS  | ignore               |
| D3P_PART_NAME                | char       | 80             | ipart                |
| D3P_PART_INTERNAL_ENERGY     | float      | 1              | ist, ipart           |
| D3P_PART_KINETIC_ENERGY      | float      | 1              | ist, ipart           |
| D3P_PART_VELOCITY            | D3P_Vector | 1              | ist, ipart           |
| D3P_PART_MASS                | float      | 1              | ist, ipart           |
| D3P_PART_HOURLASS            | float      | 1              | ist, ipart           |
| D3P_PART_INTERNAL_ID         | int        | 1              | iuser                |
| RIGID WALL                   |            |                |                      |
| D3P_NUM_RIGID_WALL           | int        | 1              | ignore               |
| D3P_RIGID_WALL_FORCE         | float      | 1              | ist,<br>i_rigid_wall |
| D3P_RIGID_WALL_POSITION      | D3P_Vector | 1              | ist,<br>i_rigid_wall |
| NODE                         |            |                |                      |
| D3P_NUM_NODES                | int        | 1              | ignore               |
| D3P_NODE_INITIAL_COORDINATES | D3P_Vector | D3P_NUM_NODES  | ignore               |



|                                    |                  |                |                       |
|------------------------------------|------------------|----------------|-----------------------|
| D3P_NODE_IDS                       | int              | D3P_NUM_NODES  | ignore                |
| D3P_NODE_TEMPERATURE               | float            | D3P_NUM_NODES  | ist                   |
| D3P_NODE_COORDINATES               | D3P_Vector       | D3P_NUM_NODES  | ist                   |
| D3P_NODE_VELOCITIES                | D3P_Vector       | D3P_NUM_NODES  | ist                   |
| D3P_NODE_ACCELERATIONS             | D3P_Vector       | D3P_NUM_NODES  | ist                   |
| D3P_NODE_COORDINATES_DOUBLE        | D3P_VectorDouble | D3P_NUM_NODES  | ist                   |
| D3P_NODE_VELOCITIES_DOUBLE         | D3P_VectorDouble | D3P_NUM_NODES  | ist                   |
| D3P_NODE_ACCELERATIONS_DOUBLE      | D3P_VectorDouble | D3P_NUM_NODES  | ist                   |
| D3P_NODE_INTERNAL_ID               | int              | 1              | iuser                 |
| SOLID                              |                  |                |                       |
| D3P_NUM_SOLID                      | int              | 1              | ignore                |
| D3P_SOLID_MAXINT                   | int              | 1              | ignore                |
| D3P_SOLID_CONNECTIVITY_MAT         | D3P_Solid        | D3P_NUM_SOLID  | ignore                |
| D3P_SOLID_IDS                      | int              | D3P_NUM_SOLID  | ignore                |
| D3P_SOLID_STRESS                   | D3P_Tensor       | D3P_NUM_SOLID  | ist, ipt if necessary |
| D3P_SOLID_EFFECTIVE_PLASTIC_STRAIN | float            | D3P_NUM_SOLID  | ist, ipt if necessary |
| D3P_SOLID_STRAIN                   | D3P_Tensor       | D3P_NUM_SOLID  | ist, ipt if necessary |
| D3P_SOLID_HISTORY_VAR              | float            | D3P_NUM_SOLID  | ist, ipt, ihv         |
| D3P_SOLID_INTERNAL_ID              | int              | 1              | iuser                 |
| TSHELL                             |                  |                |                       |
| D3P_NUM_TSHELL                     | int              | 1              | ignore                |
| D3P_TSHELL_MAXINT                  | int              | 1              | ignore                |
| D3P_TSHELL_CONNECTIVITY_MAT        | D3P_Tshell       | D3P_NUM_TSHELL | ignore                |

|                                     |            |                |               |
|-------------------------------------|------------|----------------|---------------|
| D3P_TSHELL_IDS                      | int        | D3P_NUM_TSHELL | ignore        |
| D3P_TSHELL_STRESS                   | D3P_Tensor | D3P_NUM_TSHELL | ist, ipt      |
| D3P_TSHELL_EFFECTIVE_PLASTIC_STRAIN | float      | D3P_NUM_TSHELL | ist, ipt      |
| D3P_TSHELL_STRAIN                   | D3P_Tensor | D3P_NUM_TSHELL | ist, ipt      |
| D3P_TSHELL_HISTORY_VAR              | float      | D3P_NUM_TSHELL | ist, ipt, ihv |
| D3P_TSHELL_INTERNAL_ID              | int        | 1              | iuser         |
| BEAM                                |            |                |               |
| D3P_NUM_BEAM                        | int        | 1              | ignore        |
| D3P_BEAM_MAXINT                     | int        | 1              | ignore        |
| D3P_BEAM_CONNECTIVITY_THIRD_MAT     | D3P_Beam   | D3P_NUM_BEAM   | ignore        |
| D3P_BEAM_IDS                        | int        | D3P_NUM_BEAM   | ignore        |
| D3P_BEAM_AXIAL_FORCE                | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_S_SHEAR_RESULTANT          | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_T_SHEAR_RESULTANT          | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_S_BENDING_MOMENT           | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_T_BENDING_MOMENT           | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_TORSIONAL_RESULTANT        | float      | D3P_NUM_BEAM   | ist           |
| D3P_BEAM_RS_SHEAR_STRESS            | float      | D3P_NUM_BEAM   | ist, ipt      |
| D3P_BEAM_TR_SHEAR_STRESS            | float      | D3P_NUM_BEAM   | ist, ipt      |
| D3P_BEAM_AXIAL_STRESS               | float      | D3P_NUM_BEAM   | ist, ipt      |
| D3P_BEAM_AXIAL_PLASTIC_STRAIN       | float      | D3P_NUM_BEAM   | ist, ipt      |
| D3P_BEAM_AXIAL_STRAIN               | float      | D3P_NUM_BEAM   | ist, ipt      |
| D3P_BEAM_HISTORY_VAR                | float      | D3P_NUM_BEAM   | ist, ipt, ihv |
| D3P_BEAM_INTERNAL_ID                | int        | 1              | iuser         |
| SHELL                               |            |                |               |

|                                    |            |                |               |
|------------------------------------|------------|----------------|---------------|
| D3P_NUM_SHELL                      | int        | 1              | ignore        |
| D3P_SHELL_MAXINT                   | int        | 1              | ignore        |
| D3P_SHELL_CONNECTIVITY_MAT         | D3P_Shell  | D3P_NUM_SHELL  | ignore        |
| D3P_SHELL_IDS                      | int        | D3P_NUM_SHELL  | ignore        |
| D3P_SHELL_STRESS                   | D3P_Tensor | D3P_NUM_SHELL  | ist, ipt      |
| D3P_SHELL_EFFECTIVE_PLASTIC_STRAIN | float      | D3P_NUM_SHELL  | ist, ipt      |
| D3P_SHELL_STRAIN                   | D3P_Tensor | D3P_NUM_SHELL  | ist, ipt      |
| D3P_SHELL_HISTORY_VAR              | float      | D3P_NUM_SHELL  | ist, ipt, ihv |
| D3P_SHELL_MX                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_MY                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_MXY                      | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_QX                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_QY                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_NX                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_NY                       | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_NXY                      | float      | D3P_NUM_SHELL  | ist           |
| D3P_SHELL_INTERNAL_ID              | int        | 1              | iuser         |
| DELETION                           |            |                |               |
| D3P_HAS_DELETION                   | bool       | 1              | ist           |
| D3P_SOLID_DELETION                 | float      | D3P_NUM_SOLID  | ist           |
| D3P_TSHELL_DELETION                | float      | D3P_NUM_TSHELL | ist           |
| D3P_SHELL_DELETION                 | float      | D3P_NUM_SHELL  | ist           |
| D3P_BEAM_DELETION                  | float      | D3P_NUM_BEAM   | ist           |
| SPH                                |            |                |               |
| D3P_NUM_SPH                        | int        | 1              | ignore        |
| D3P_SPH_NODE_MAT                   | D3P_Sph    | D3P_NUM_SPH    | ignore        |

|                                      |            |                              |                   |
|--------------------------------------|------------|------------------------------|-------------------|
| D3P_SPH_RADIUS                       | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_PRESSURE                     | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_STRESS                       | D3P_Tensor | D3P_NUM_SPH                  | ist               |
| D3P_SPH_PLASTIC_STRAIN               | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_DENSITY                      | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_INTERNAL_ENERGY              | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_NUMBER_OF_PARTICLE_NEIGHBORS | int        | D3P_NUM_SPH                  | ist               |
| D3P_SPH_STRAIN                       | D3P_Tensor | D3P_NUM_SPH                  | ist               |
| D3P_SPH_MASS                         | float      | D3P_NUM_SPH                  | ist               |
| D3P_SPH_INTERNAL_ID                  | int        | 1                            | iuser             |
| DES                                  |            |                              |                   |
| D3P_HAS_DES_DATA                     | bool       | 1                            | ignore            |
| D3P_NUM_DES_DATA                     | int        | 1                            | ignore            |
| D3P_NUM_DES_PART_IN_GEOM             | int        | 1                            | ides if necessary |
| D3P_NUM_DES_ELEM_IN_GEOM             | int        | 1                            | ides if necessary |
| D3P_NUM_DES_PART_IN_STATE            | int        | 1                            | ides if necessary |
| D3P_NUM_DES_ELEM_IN_STATE            | int        | 1                            | ides if necessary |
| D3P_NUM_DES_PART_VAR_IN_GEOM         | int        | 1                            | ides if necessary |
| D3P_DES_PART_VAR_LIST_IN_GEOM        | D3P_Var    | D3P_NUM_DES_PART_VAR_IN_GEOM | ides if necessary |
| D3P_NUM_DES_ELEM_VAR_IN_GEOM         | int        | 1                            | ides if necessary |
| D3P_DES_ELEM_VAR_LIST_IN_GEOM        | D3P_Var    | D3P_NUM_DES_ELEM_VAR_IN_GEOM | ides if necessary |
| D3P_NUM_DES_PART_VAR_IN_STATE        | int        | 1                            | ides if necessary |

|                                       |                                    |                               |                                  |
|---------------------------------------|------------------------------------|-------------------------------|----------------------------------|
| D3P_DES_PART_VAR_LIST_IN_STATE        | D3P_Var                            | D3P_NUM_DES_PART_VAR_IN_STATE | ides if necessary                |
| D3P_NUM_DES_ELEM_VAR_IN_STATE         | int                                | 1                             | ides if necessary                |
| D3P_DES_ELEM_VAR_LIST_IN_STATE        | D3P_Var                            | D3P_NUM_DES_ELEM_VAR_IN_STATE | ides if necessary                |
| D3P_DES_NODAL_MAT_RADIUS_MASS_INERTIA | D3P_Des                            | D3P_NUM_DES_ELEM_IN_GEOM      | ides if necessary                |
| D3P_DES_DATA_IN_STATE                 | int/float/vector/tensor... depends | D3P_NUM_DES_ELEM_IN_STATE     | var_name, ist, ides if necessary |
| CPM                                   |                                    |                               |                                  |
| D3P_HAS_CPM_DATA                      | bool                               | 1                             | ignore                           |
| D3P_CPM_NUM_AIRBAGS                   | int                                | 1                             | ignore                           |
| D3P_CPM_NUM_PARTICLES                 | int                                | 1                             | ignore                           |
| D3P_CPM_NUM_GEOM_VAR                  | int                                | 1                             | ignore                           |
| D3P_CPM_GEOM_VAR_LIST                 | D3P_Var                            | D3P_CPM_NUM_GEOM_VAR          | ignore                           |
| D3P_CPM_GEOM_DATA                     | D3P_Var                            | D3P_CPM_NUM_GEOM_VAR          | ignore                           |
| D3P_CPM_NUM_STATE_VAR                 | int                                | 1                             | ignore                           |
| D3P_CPM_STATE_VAR_LIST                | D3P_Var                            | D3P_CPM_NUM_STATE_VAR         | ignore                           |
| D3P_CPM_STATE_DATA                    | int/float... depends               | D3P_CPM_NUM_PARTICLES         | var_name, ist                    |
| D3P_CPM_NUM_STATE_GEOM_VAR            | int                                | 1                             | ignore                           |
| D3P_CPM_STATE_GEOM_VAR_LIST           | D3P_Var                            | D3P_CPM_NUM_STATE_GEOM_VAR    | ignore                           |
| D3P_CPM_STATE_GEOM_DATA               | int/float... depends               | D3P_CPM_NUM_AIRBAGS           | var_name, ist                    |
| Multisolver                           |                                    |                               |                                  |

|                                        |           |                                 |                               |
|----------------------------------------|-----------|---------------------------------|-------------------------------|
| D3P_HAS_MS_DATA                        | bool      | 1                               | ignore                        |
| D3P_MS_NUM_DOMAINS                     | int       | 1                               | ignore                        |
| D3P_MS_DOMAIN_ID                       | int       | 1                               | index_multi<br>solver         |
| D3P_MS_DOMAIN_NAME                     | char      | 80                              | index_multi<br>solver         |
| D3P_MS_DOMAIN_VAR_NUM                  | int       | 1                               | index_multi<br>solver         |
| D3P_MS_DOMAIN_VARS_LIST                | int       | D3P_MS_DOMAIN_VAR_NUM           | index_multi<br>solver         |
| D3P_MS_VAR_NAME                        | char      | 80                              | id_var_multi<br>solver        |
| D3P_MS_VAR_IS_VECTOR                   | bool      | 1                               | id_var_multi<br>solver        |
| D3P_MS_VAR_IS_SCALAR                   | bool      | 1                               | id_var_multi<br>solver        |
| D3P_MS_VAR_IS_TENSOR                   | bool      | 1                               | id_var_multi<br>solver        |
| D3P_MS_DOMAIN_VAR_LENGTH               | int       | 1                               | ist,<br>index_multi<br>solver |
| D3P_MS_DOMAIN_IS_SOLID                 | bool      | 1                               | ist,<br>index_multi<br>solver |
| D3P_MS_DOMAIN_IS_SHELL                 | bool      | 1                               | ist,<br>index_multi<br>solver |
| D3P_MS_DOMAIN_IS_BEAM                  | bool      | 1                               | ist,<br>index_multi<br>solver |
| D3P_MS_DOMAIN_ELEM_NUM_IN_STATE        | int       | 1                               | ist,<br>index_multi<br>solver |
| D3P_MS_SOLID_CONNECTIVITY_MAT_IN_STATE | D3P_Solid | D3P_MS_DOMAIN_ELEM_NUM_IN_STATE | ist,<br>index_multi<br>solver |

|                                            |                                         |                                           |                                                          |
|--------------------------------------------|-----------------------------------------|-------------------------------------------|----------------------------------------------------------|
| D3P_MS_SHELL_CONNECTIVITY_MAT_IN_STATE     | D3P_Shell                               | D3P_MS_DOMAIN_ELEM_NUM_IN_STATE           | ist,<br>index_multi<br>solver                            |
| D3P_MS_BEAM_CONNECTIVITY_MAT_IN_STATE      | D3P_Beam                                | D3P_MS_DOMAIN_ELEM_NUM_IN_STATE           | ist,<br>index_multi<br>solver                            |
| D3P_MS_DOMAIN_NODE_NUM_IN_STATE            | int                                     | 1                                         | ist,<br>index_multi<br>solver                            |
| D3P_MS_DOMAIN_COORD_IN_STATE               | D3P_Vector                              | D3P_MS_DOMAIN_NODE_NUM_IN_STATE           | ist,<br>index_multi<br>solver                            |
| D3P_MS_DOMAIN_DATA_IN_STATE                | float or<br>D3P_Vector or<br>D3P_Tensor | D3P_MS_DOMAIN_VAR_LENGTH                  | ist,<br>index_multi<br>solver,id_v<br>ar_multisol<br>ver |
| D3P_MS_DOMAIN_DATA_IS_ON_STRUCTURE_ELEMENT | bool                                    | 1                                         | index_multi<br>solver                                    |
| D3P_MS_DOMAIN_DATA_IS_ON_MS_NODE           | bool                                    | 1                                         | index_multi<br>solver                                    |
| D3P_MS_DOMAIN_DATA_IS_ON_MS_ELEMENT,       | bool                                    | 1                                         | index_multi<br>solver                                    |
| D3P_MS_DOMAIN_IS_FOLLOW_SURFACE_METHOD     | bool                                    | 1                                         | index_multi<br>solver                                    |
| D3P_MS_DOMAIN_NODE_NUM_ONSURFACE_IN_STATE  | int                                     | 1                                         | ist,<br>index_multi<br>solver                            |
| D3P_MS_DOMAIN_SURFACE_IDS_IN_STATE         | int                                     | D3P_MS_DOMAIN_NODE_NUM_ONSURFACE_IN_STATE | ist,<br>index_multi<br>solver                            |

## How to use

### *Sample1.py*

**Purpose:** obtain resultant displacement for all the nodes and find maximum value.

3D scatterplot(x=shell\_nodes\_x, y=shell\_nodes\_y, z=shell\_nodes\_z, c=resultant displacement of shell nodes)

ist: last.

---

```
from lsreader import D3plotReader, DataType as dt
import os
import matplotlib.pyplot as plt
from mpl_toolkits import mplot3d
from math import pow

d3plot = os.path.join(os.getcwd(), 'd3plot')
dr = D3plotReader(d3plot)

num_states = dr.get_data(dt.D3P_NUM_STATES)
nodes_init_coor = dr.get_data(
 dt.D3P_NODE_INITIAL_COORDINATES, ist=num_states-1
)
nodes_coor = dr.get_data(dt.D3P_NODE_COORDINATES, ist=num_states-1)

obtain resultant displacement for all nodes and find maximum
nodes_res_disp = []
for i in range(nodes_coor.__len__()):
 disp_x = nodes_coor[i].x() - nodes_init_coor[i].x()
 disp_y = nodes_coor[i].y() - nodes_init_coor[i].y()
 disp_z = nodes_coor[i].z() - nodes_init_coor[i].z()
```



```

tmp = pow(displ_x, 2) + pow(displ_y, 2) + pow(displ_z, 2)
nodes_res_displ.append(pow(tmp, 0.5))

print(
 """
Maximum resultant displacement of nodes is: {0}, index is: {1}
""".format(
 max(nodes_res_displ), nodes_res_displ.index(max(nodes_res_displ))
)
)

nodes coordinates of shell elements when ist=last
shells = dr.get_data(dt.D3P_SHELL_CONNECTIVITY_MAT)
nodes_shell = []
for shell in shells:
 nodes_shell.append(shell.node(0))
 nodes_shell.append(shell.node(1))
 nodes_shell.append(shell.node(2))
 nodes_shell.append(shell.node(3))
nodes_shell = list(set(nodes_shell))
nodes_shell.sort()
nodes_x, nodes_y, nodes_z, res = [], [], [], []
for node_shell in nodes_shell:
 nodes_x.append(nodes_coor[node_shell-1].x())
 nodes_y.append(nodes_coor[node_shell-1].y())
 nodes_z.append(nodes_coor[node_shell-1].z())
 res.append(nodes_res_displ[node_shell-1])

```

```
plotting

fig = plt.figure()

ax = fig.add_subplot(1, 1, 1, projection='3d')

scat = ax.scatter3D(
 nodes_x, nodes_y, nodes_z, c=res, s=15,
)

fig.colorbar(scat, label='Resultant Displacement')

ax.set_zlim3d(-50, 50)

plt.show()
```

## *Sample2.py*

**Purpose:** extract Variable data for Multisolver.

**State:** 2

---

```
import lsreader

from lsreader import D3plotReader

from lsreader import DataType as dt

from lsreader import D3P_Parameter as dp

import os

d3plot = os.path.join(os.getcwd(), 'd3plot')

dr = D3plotReader(d3plot)

has_ms_data = dr.get_data(dt.D3P_HAS_MS_DATA)

if not has_ms_data:

 print("No Multisolver Data")

num_ms_datasets = dr.get_data(dt.D3P_MS_NUM_DOMAINS)

for dataset in range(num_ms_datasets):

 domain_var_ids = dr.get_data(dt.D3P_MS_DOMAIN_VARS_LIST, index_multisolver=dataset)

 for var in range(domain_var_ids.__len__()):

 sizevar = dr.get_data(dt.D3P_MS_DOMAIN_VAR_LENGTH, index_multisolver=dataset, ist=2)

 is_scalar = dr.get_data(dt.D3P_MS_VAR_IS_SCALAR, id_var_multisolver=domain_var_ids[var])

 is_vector = dr.get_data(dt.D3P_MS_VAR_IS_VECTOR, id_var_multisolver=domain_var_ids[var])
```

```

 is_tensor = dr.get_data(dt.D3P_MS_VAR_IS_TENSOR, id_var_multisolver=domain_var_ids[var])
 p = dp()
 p.ist=2
 p.index_multisolver = dataset
 p.id_var_multisolver = domain_var_ids[var]
 if is_scalar:
 svalue = dr.get_data(dt.D3P_MS_DOMAIN_DATA_IN_STATE, p)
 print("Value type: scalar, value[0]={}".format(svalue[0]))
 if is_vector:
 vvalue = dr.get_data(dt.D3P_MS_DOMAIN_DATA_IN_STATE, p)
 print(
 "Value type: vector, value[0].X()={}"
 .format(vvalue[0].x())
)
 if is_tensor:
 tvalue = dr.get_data(dt.D3P_MS_DOMAIN_DATA_IN_STATE, p)
 print(
 "Value type: tensor, value[0].X()={}"
 .format(tvalue[0].x())
)

```

---

### *Sample3.py*

**Purpose:** extract stress of shells by part.

**State:** 2

**Ipt:** 0

**Part User Id:** 3

---

```
from lsreader import D3plotReader, DataType as dt

d3plot = os.path.join(os.getcwd(), 'd3plot')
dr = D3plotReader(d3plot)

num_shells = dr.get_data(dt.D3P_NUM_SHELL)
shell_stress = dr.get_data(
 dt.D3P_SHELL_STRESS, ist=1, ipt=0, ipart_user=3
)
do something with shell_stress
```

## BinoutReader

### API Functions

```
class BinoutReader():
```

```
 def __init__(self, path):
```

```
 pass
```

❖ Purpose: Constructor.

❖ Input: path: binout name.

❖ Return: BinoutReader object.

Example: br = BinoutReader("binout/file/path")

---

```
@staticmethod
```

```
def is_valid(path):
```

```
 pass
```

❖ Purpose: Check if the path is correct

❖ Input: path: binout name(full path).

❖ Return: True or False.

---

```
@staticmethod
```

```
def write(path, x_array, y_array):
```

```
 pass
```

❖ Purpose: Output the x\_array and y\_array to path.

❖ Input: path: binout name(full path).

    x\_array: The array of X direction.

    y\_array: The array of Y direction.

❖ Return: True.

---

```
def get_branch(self):
```

```
 pass
```

❖ Purpose: Get branches.

❖ Input: void.

❖ Return: The array of branches.

---

```
def set_branch(self, branch):
```

```
 pass
```

❖ Purpose: Set current branch.

❖ Input: branch: The name of the branch to set.

❖ Return: True.

---

```
def set_id(self, id, master):
```

```
 pass
```

❖ Purpose: Set current id.

❖ Input: id: The id to set. It can be string or integer.

master: choose master or slave. It can be ignored.

❖ Return: True.

---

```
def get_id(self):
```

```
 pass
```

❖ Purpose: Get ids.

❖ Input: void.

❖ Return: The array of ids.

---

```
def set_component(component):
```

```
 pass
```

- ❖ Purpose: Set current component.
  - ❖ Input: branch: The name of the component to set.
  - ❖ Return: True.
- 

```
def get_component():
```

```
 pass
```

- ❖ Purpose: Get components.
  - ❖ Input: void.
  - ❖ Return: The array of components.
- 

```
def get_x_array():
```

```
 pass
```

- ❖ Purpose: Get the array of X direction.
  - ❖ Input: void.
  - ❖ Return: The array of X direction.
- 

```
def get_y_array():
```

```
 pass
```

- ❖ Purpose: Get the array of Y direction.
  - ❖ Input: void.
  - ❖ Return: The array of Y direction.
-



## How to use

### *Sample1.py*

**Purpose:** obtain branches and component, and get x\_array, y\_array.

**Branch:** nodout.

**Component:** x\_acceleration.

**Id:** 1787

**Ouput:** nodoutPy.dat

---

```
br = BinoutReader(data_path)

res = BinoutReader.is_valid(data_path)
print(res)

branches = br.get_branch()
for branch in branches:
 print(branch, end=', ')

br.set_branch('nodout')
br.set_id(1787)
br.set_component('x_acceleration')
x_array = br.get_x_array()
y_array = br.get_y_array()
out_path = os.path.join(cwd, 'nodoutPy.dat')
BinoutReader.write(out_path, x_array, y_array)
```

