

NumericalBox3D DLSSM

Part IV: Solver-01

Gao-Feng Zhao

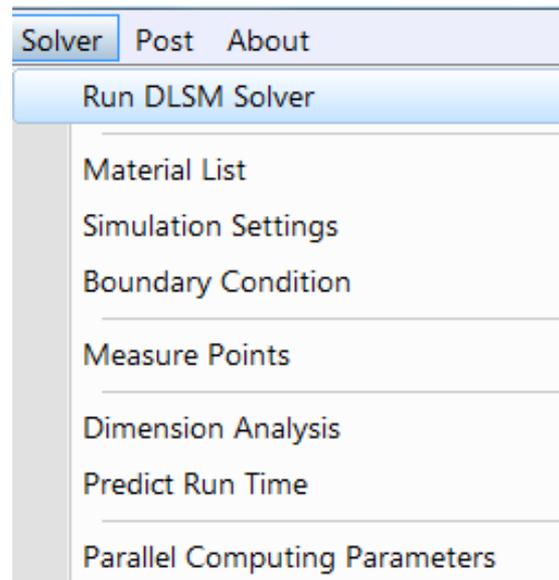
Tianjin University

2019-11-26

www.dembox.org

The Menu

Menu



Solver

Run DLSTM Solver

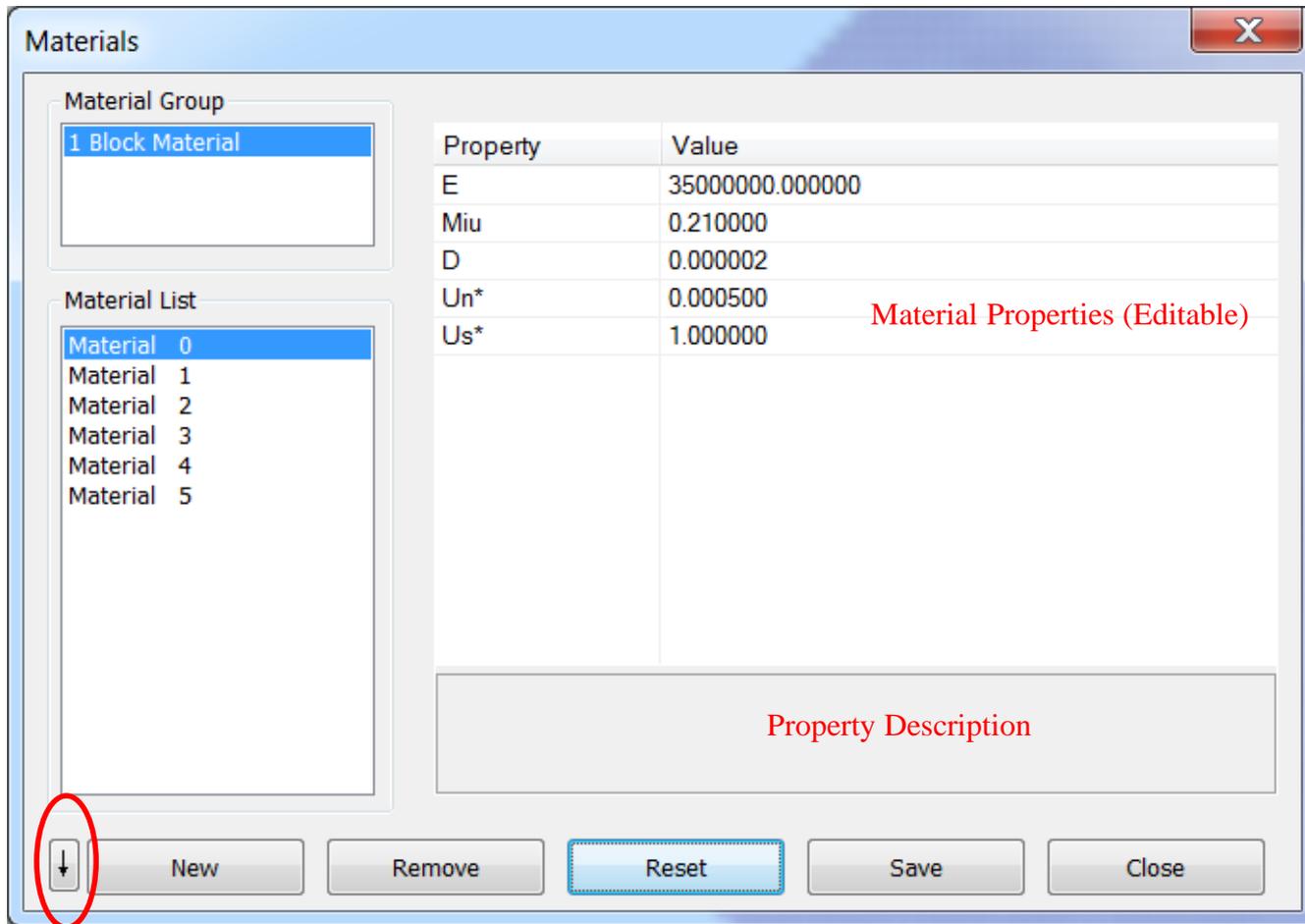
The screenshot displays the HelloDLSTM software interface. The main window shows a 3D visualization of a lattice structure, which is a semi-circular arrangement of particles. A red arrow points from the 'Run DLSTM Solver' button in the 'Solver' menu to the lattice. A terminal window is open, displaying the following text:

```
=====
DLSTM3D 3.0
Distinct Lattice Spring Model (DLSTM)
Copyright (c) 2013-2020
Author: Gao-Feng ZHAO
=====

The machine has 8 CPUs and the code will use 8 of them.
TOTAL BALLS: 280
TOTAL BALLS: 280
L2= 1.00418e+006 U=19650
The micro parameters are auto selected as:
Kn= 3.54253e+006 Ks= 468433
0 0
Output result file: OutPut\MLSout00000000.bin
37.8209 0
Output result file: OutPut\MLSout00000010.bin
72.3551 0
Output result file: OutPut\MLSout00000020.bin
105.738 0
Output result file: OutPut\MLSout00000030.bin
```

The interface includes a 'Project View' on the left, a 'Solver' menu on the right with options like 'Material List', 'Simulation Settings', and 'Boundary Condition', and a status bar at the bottom showing 'Ready'.

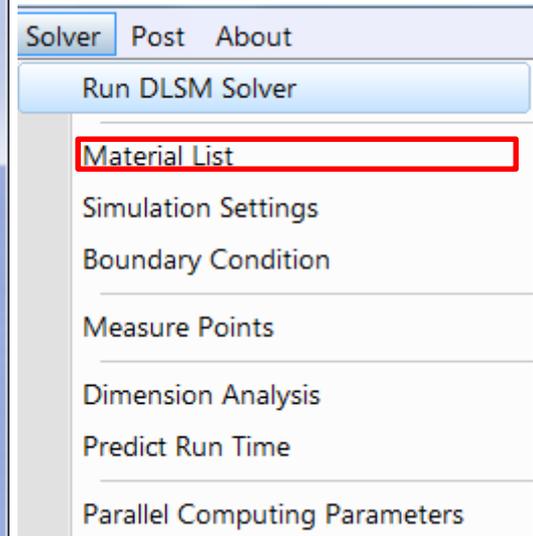
Material List



The Materials dialog box is shown with the following components:

- Material Group:** A list containing "1 Block Material".
- Material List:** A list containing "Material 0", "Material 1", "Material 2", "Material 3", "Material 4", and "Material 5".
- Property Table:**

Property	Value
E	35000000.000000
Miu	0.210000
D	0.000002
Un*	0.000500
Us*	1.000000
- Property Description:** A text area containing "Property Description".
- Buttons:** "New", "Remove", "Reset", "Save", and "Close".
- Navigation:** A small square button with a downward arrow is circled in red at the bottom left.



The Solver menu is shown with the following items:

- Solver
- Post
- About
- Run DSLM Solver
- Material List** (highlighted with a red box)
- Simulation Settings
- Boundary Condition
- Measure Points
- Dimension Analysis
- Predict Run Time
- Parallel Computing Parameters

Material List

Materials

Material Group

- 1 Block Material

Material List

- Material 0
- Material 1
- Material 2
- Material 3
- Material 4
- Material 5

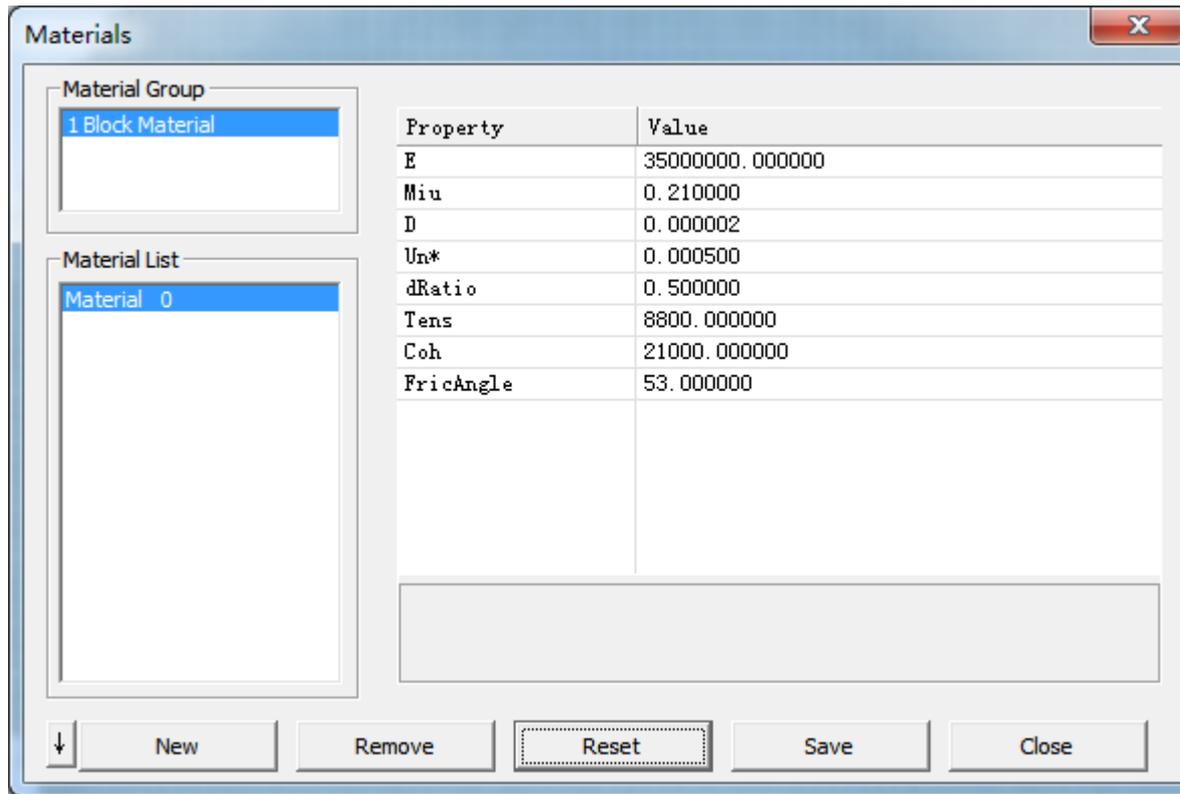
Property	Value
E	35000000.000000
Miu	0.210000
D	0.000002
Un*	0.000500
Us*	1.000000

↑ New Remove Reset Save Close

	Density (kg/m ³)	Elastic Modulus (GPa)	Poisson's Ratio	Tensile Strength (MPa)	UCS (MPa)
Steel	8000	200	0.3	400	250
Sandstone	2000	1-20	0.21-0.38	4-25	20-170
Shale	2500	1-70	0.2-0.4	2-10	5-100
Granite	2700	10-70	0.1-0.3	7-25	100-250

Material parameters of **DLSM/4D-LSM**

Material List



Material parameters of
Multi-body 4D-LSM

Simulation Settings

Simulation Setting

Property	Value
Lx	50.000000
Ly	50.000000
Lz	10.000000
CellSize	2.000000
dGap	0.500000
dT	5e-008
T	0.0002
dURatio	0.000100
nOutLoops	10.000000
Gx	0.000000
Gy	0.000000
Gz	0.000000
Dp	0.100000

Lx
Length of the cell search box in x direction

Save Reset
Default Value Close

Solver Post About

Run DSLM Solver

Material List

Simulation Settings

Boundary Condition

Measure Points

Dimension Analysis

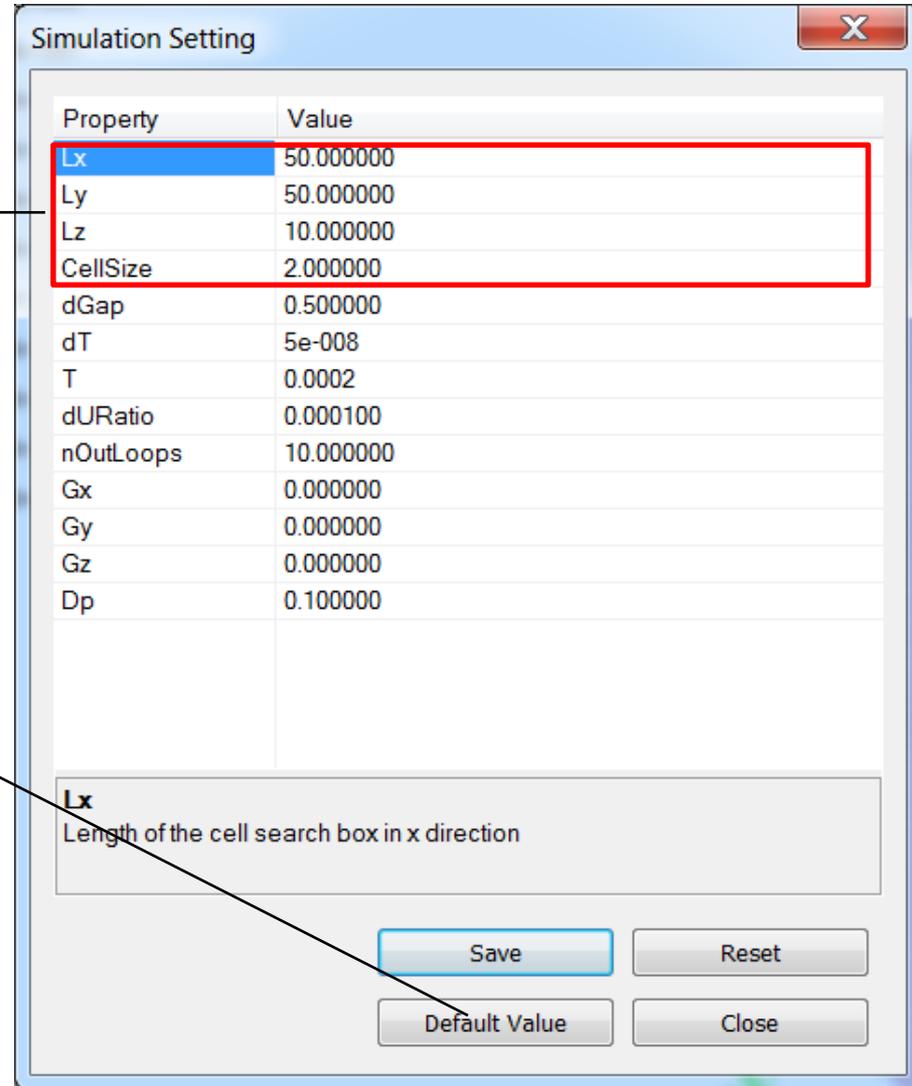
Predict Run Time

Parallel Computing Parameters

Simulation Settings

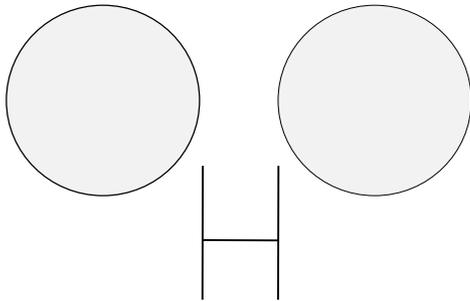
Contact detection parameters.

Automatically get default values calculated by the software.



Simulation Settings

Contact search domain size, and cell element size (cell based contact detection method).



Condition for two particles to form a bond spring pair.

Simulation Setting

Property	Value
Lx	50.000000
Ly	50.000000
Lz	10.000000
CellSize	2.000000
dGap	0.500000
dT	5e-008
T	0.0002
dURatio	0.000100
nOutLoops	10.000000
Gx	0.000000
Gy	0.000000
Gz	0.000000
Dp	0.100000

Lx
Length of the cell search box in x direction

Save Reset
Default Value Close

Boundary Condition

Boundary Condition

Load List

- 1 Load
- 2 Load

Property	Value
X1	0.000000
X2	50.000000
Y1	0.000000
Y2	0.500000
Z1	0.000000
Z2	10.000000
Type	Velocity
Direction	Y
Operation	

Z1
The low value of the range for the boundary condition in z direction

Display Load

Remove All Reset Save

Add Load Default Loads Close

Solver Post About

Run DLSM Solver

Material List

Simulation Settings

Boundary Condition

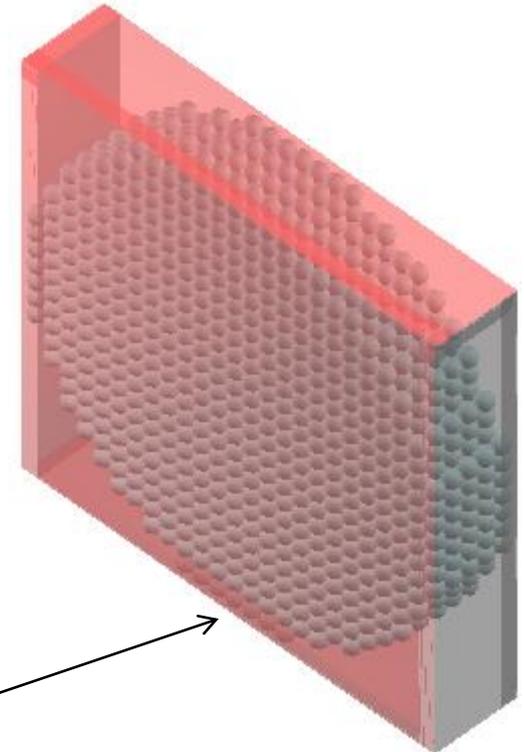
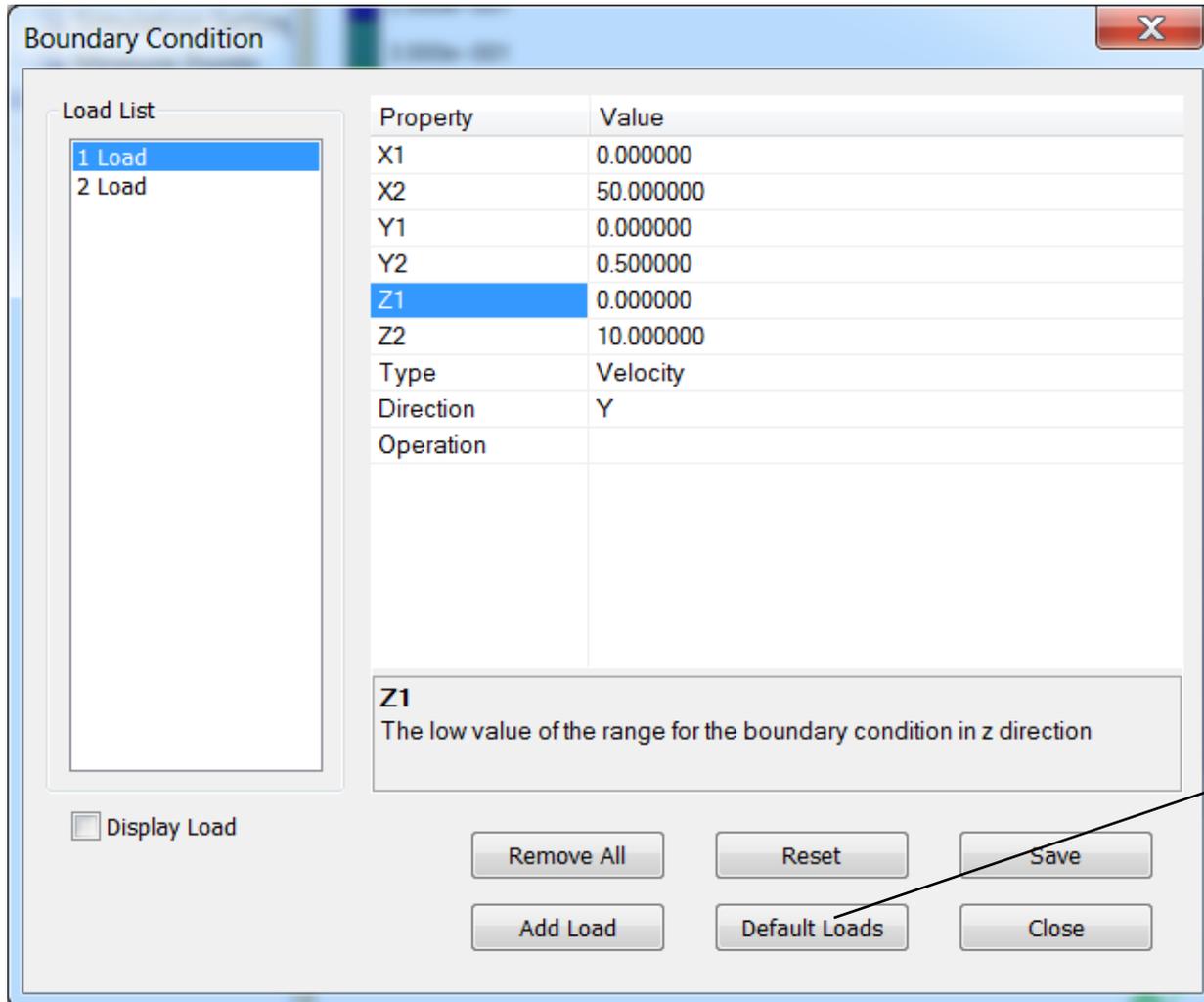
Measure Points

Dimension Analysis

Predict Run Time

Parallel Computing Parameters

Boundary Condition



Boundary Condition

Boundary Condition

Load List

- 1 Load
- 2 Load

Property	Value
X1	0.000000
X2	50.000000
Y1	0.000000
Y2	0.500000
Z1	0.000000
Z2	10.000000
Type	Velocity
Direction	Y
Operation	

Remove
New
Edit Load Data

Operation
Remove the load, New load, or Edit the load data

Display Load

Remove All Reset Save

Add Load Default Loads Close

Solver Post About

Run DLSM Solver

Material List

Simulation Settings

Boundary Condition

Measure Points

Dimension Analysis

Predict Run Time

Parallel Computing Parameters

Boundary Condition

Boundary Condition

Load List

- 1 Load
- 2 Load

Property	Value
X1	0.000000
X2	50.000000
Y1	0.000000
Y2	0.500000
Z1	0.000000
Z2	10.000000
Type	Velocity
Direction	Y
Operation	

Remove
New
Edit Load Data

Operation
Remove the load, New load, or Edit the load

Display Load

Remove All Res...
Add Load Default

Load Data

LOADING HISTORY

VALUE

0.1

0

0 5 10

TIME

View Load Data As File Read From File

Generate Curves

Type: [1] Constant

- [1] Constant
- [2] Linear
- [3] Triangle
- [4] Sin
- [5] Trapezoid

Amplitude: Zero Value Time: 0.00015

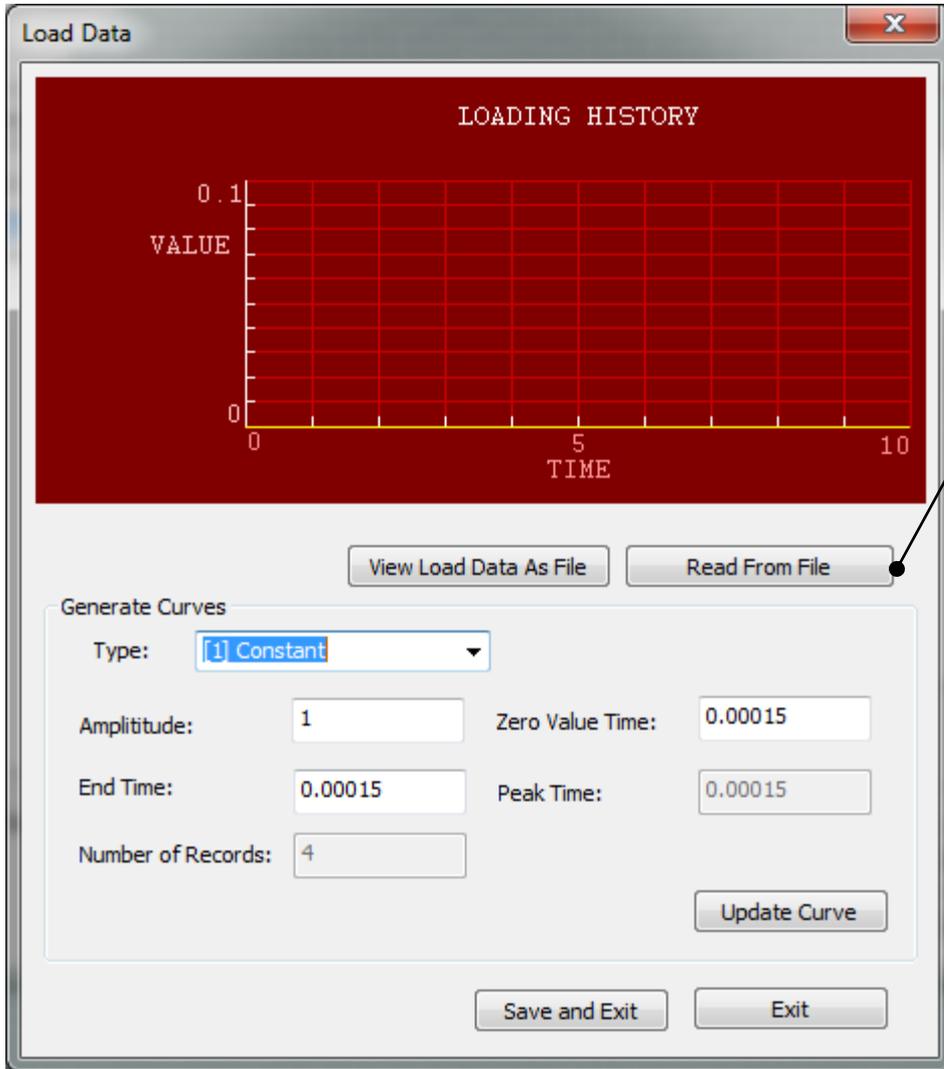
End Time: Peak Time: 0.00015

Number of Records: 4

Update Curve

Save and Exit Exit

Boundary Condition

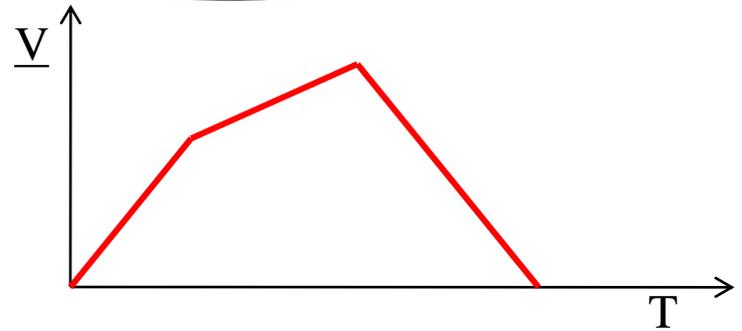


Line1: Number of record points
Line 2: Time1, Value1
Line 3: Time2, Value2

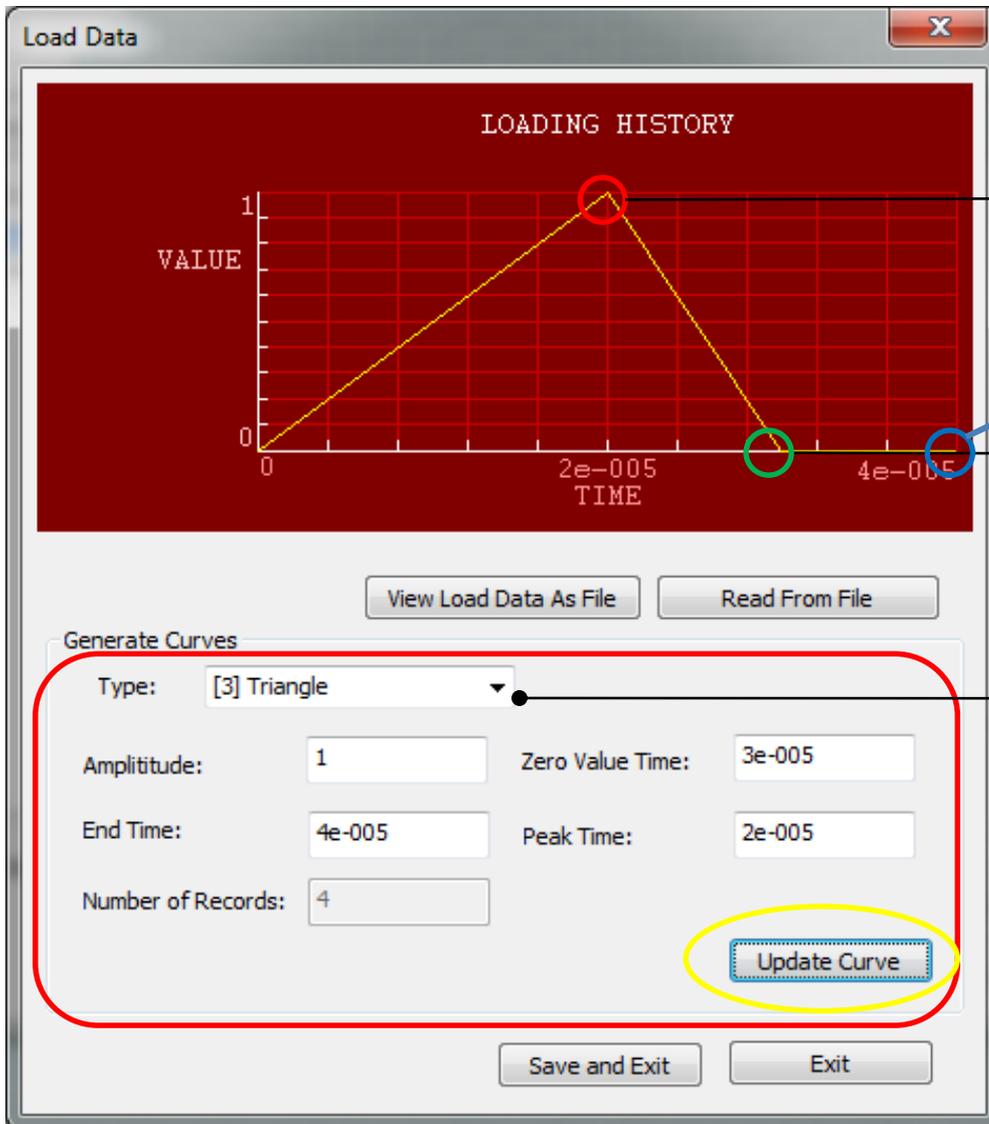
....

Example:

```
3
0 0
1 2
2 3
4 0
```



Boundary Condition



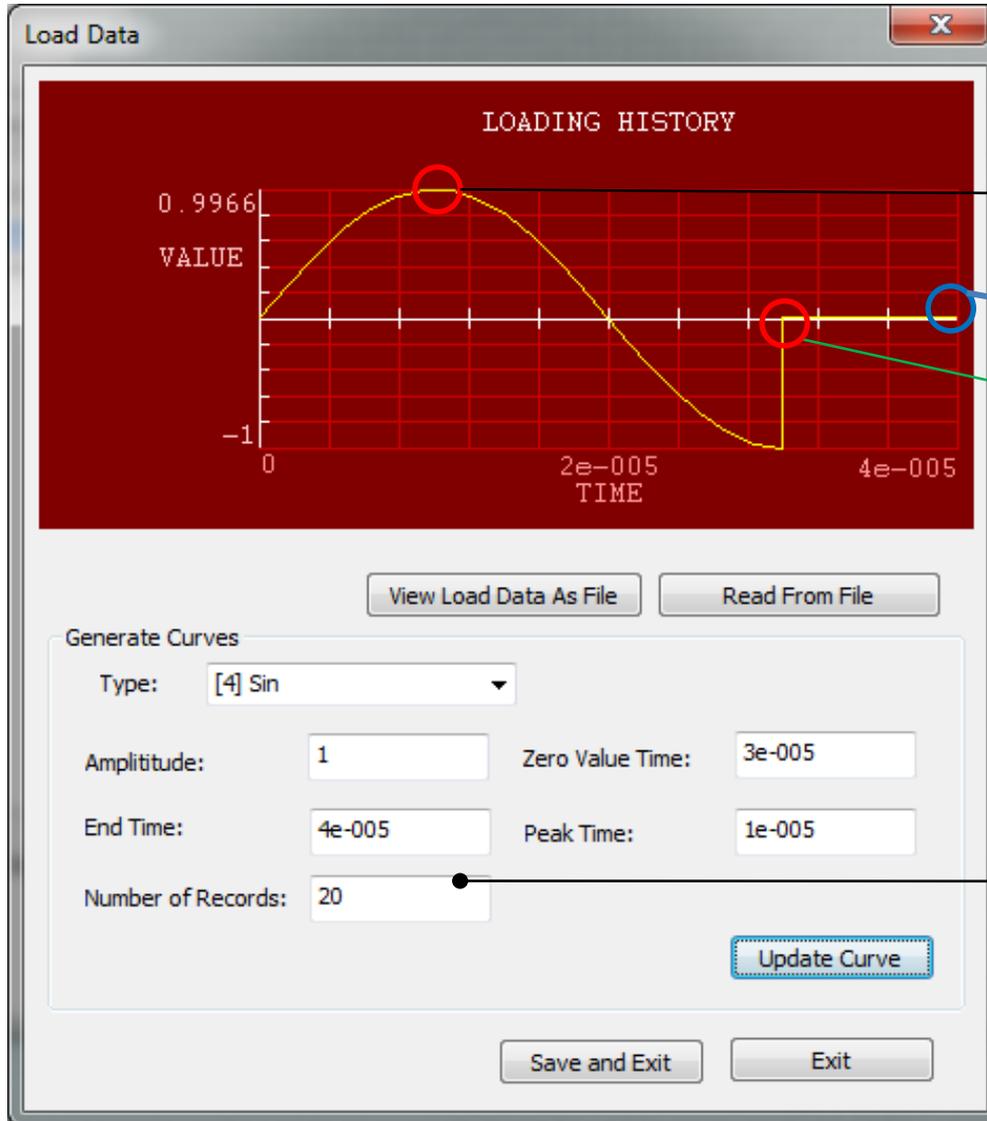
→ Peak point (Peak time, Amplitude)

→ End time.

→ Zero time.

- [1] Constant
- [1] Constant
- [2] Linear
- [3] Triangle
- [4] Sin
- [5] Trapezoid

Boundary Condition



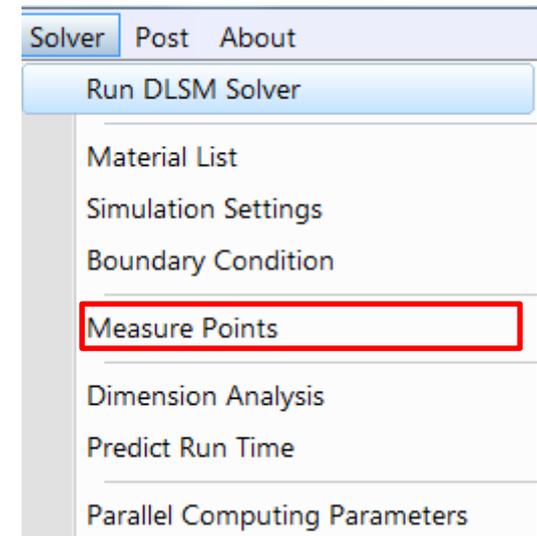
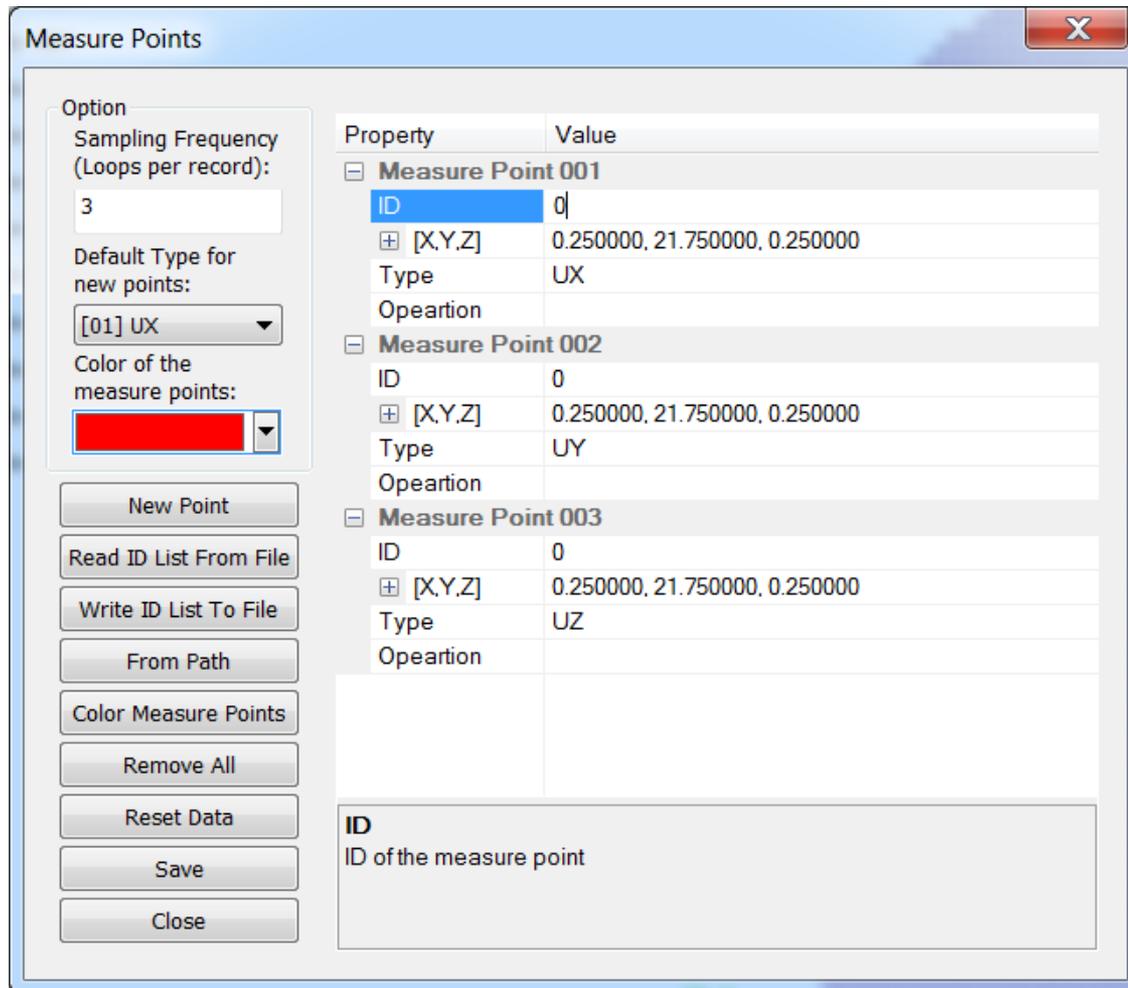
Peak point (Peak time, Amplitude)

End time.

Zero time.

Number of points to represent the curve.

Measure Points



Measure Points

The screenshot shows a software application window titled "HelloDLSMBak" with a menu bar (File, View, Prep, Solver, Post, About) and a toolbar. The main window displays a circular mesh of purple particles. A vertical color scale on the left ranges from 0.000e+000 (purple) to 1.000 (red). Three measurement points are defined:

Property	Value
<input type="checkbox"/> Measure Point 001	
ID	0
[X,Y,Z]	0.250000, 0.250000, 0.250000
Type	UX
Operation	
<input type="checkbox"/> Measure Point 002	
ID	0
[X,Y,Z]	0.250000, 0.250000, 0.250000
Type	UY
Operation	
<input type="checkbox"/> Measure Point 003	
ID	0
[X,Y,Z]	0.250000, 0.250000, 0.250000
Type	UZ
Operation	

The "Measure Points" dialog box includes the following options:

- Option: Sampling Frequency (Loops per record): 3
- Default Type for new points: [01] UX
- Color of the measure points: Red

Buttons in the "Measure Points" dialog: New Point, Read ID List From File, Write ID List To File, From Path, Color Measure Points, Remove All, Reset Data, Save, Close.

The "Colors" dialog box shows a color wheel with a red square selected. It includes buttons for OK, Cancel, and Select.. A "New" color swatch is also visible.

At the bottom center, a coordinate system is shown with a blue origin, a red arrow pointing right labeled 'X', and a green arrow pointing up labeled 'Y'.

Measure Points

The image shows a software interface for creating measure points. The main window, titled "Measure Points", has a sidebar on the left with several buttons. The "From Path" button is highlighted with a red rectangle. The main area contains a table of measure points and a "Path Operation" dialog box.

Measure Points Table:

Property	Value
[-] Measure Point 001	
ID	0
[X,Y,Z]	0.250000
Type	UX
Operation	
[-] Measure Point 002	
ID	0
[X,Y,Z]	0.250000
Type	UY
Operation	
[-] Measure Point 003	
ID	0
[X,Y,Z]	0.250000
Type	UZ
Operation	

Path Operation Dialog:

ID List:

- [001] 139
- [002] 7619
- [003] 21599
- [004] 38759
- [005] 57739
- [006] 77599
- [007] 97499
- [008] 116599
- [009] 133999
- [010] 148379
- [011] 157059

Path parameters:

PathType: [1] Line Path

X1: 0 Y1: 25 Z1: 10

X2: 50 Y2: 25 Z2: 10

nSegments: 10

Control:

Generate ID List, Remove All, Ok, Close

Option (Main Window):

Sampling Frequency (Loops per record): 3

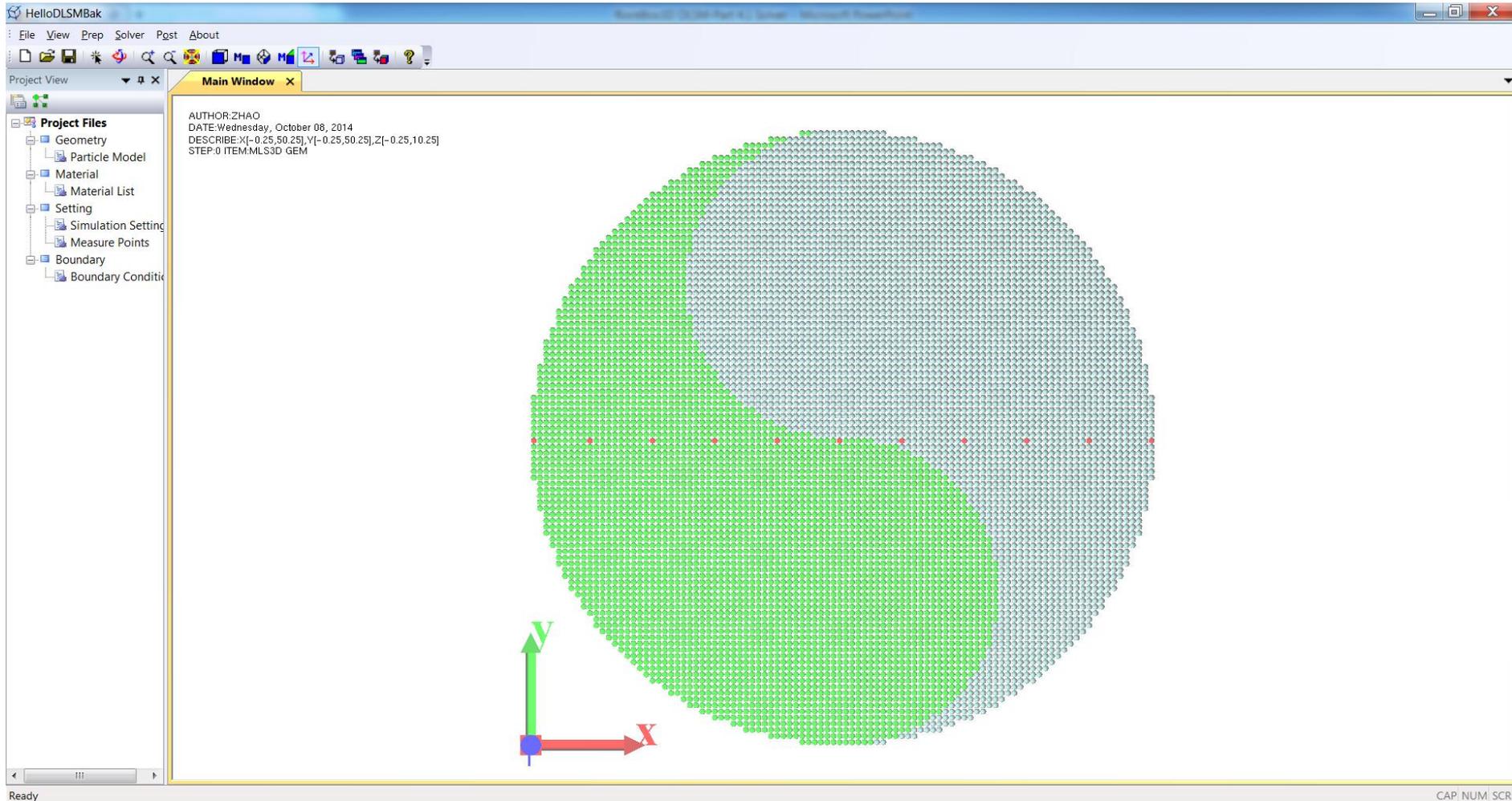
Default Type for new points: [01] UX

Color of the measure points: [Red]

Buttons: New Point, Read ID List From File, Write ID List To File, From Path, Color Measure Points, Remove All, Reset Data, Save, Close

ID
ID of the measure point

Measure Points



Dimension Analysis

Dimension Analysis

Orders Calculation

Time:	[5]1.00E+000	Second	[Time: t]	Acceleration: s/t^2
Mass:	[4]1.00E+000	Kilogram	[Mass: m]	Stress: N/s^2
Space:	[3]1.00E-003	Meter	[Space: s]	Density: m/s^3

$Force: N = ma = m \cdot s/t^2$ $Energy: ms^2/t^2$
 $Velocity: s/t$ $Therm: K$

Out Put

Force:	1.00E-003	Acceler:	1.00E-003	Density:	1.00E+009
Velocity:	1.00E-003	Stress:	1.00E+003	Energy:	1.00E-006
Volume:	1.00E-009	Area:	1.00E-006	W:	1.00E-006

Specific Heat (J/kg/K): 1.00E+000
Thermal conductivity (W/m/K): 1.00E+003

[Note:] What you see=Value* Rate, while what you input should be

Execute Close

Solver Post About

Run DLSM Solver

Material List

Simulation Settings

Boundary Condition

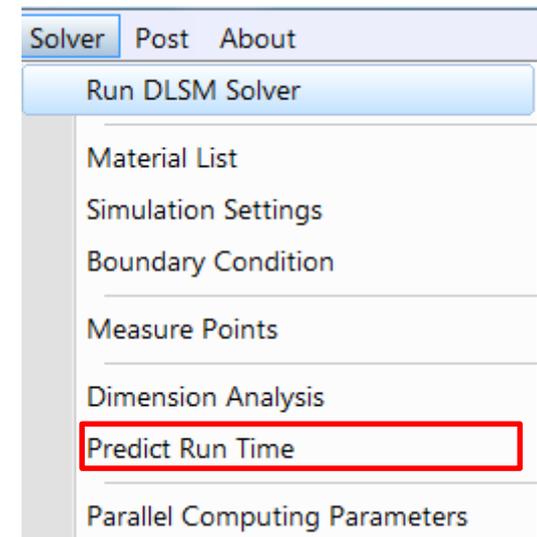
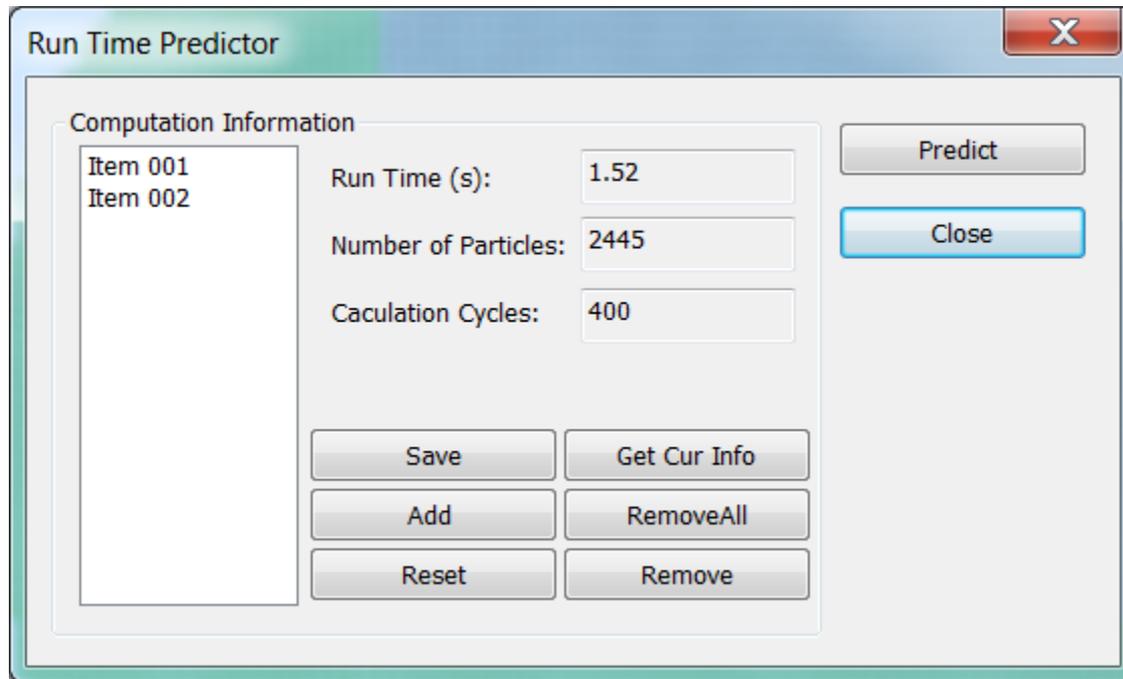
Measure Points

Dimension Analysis

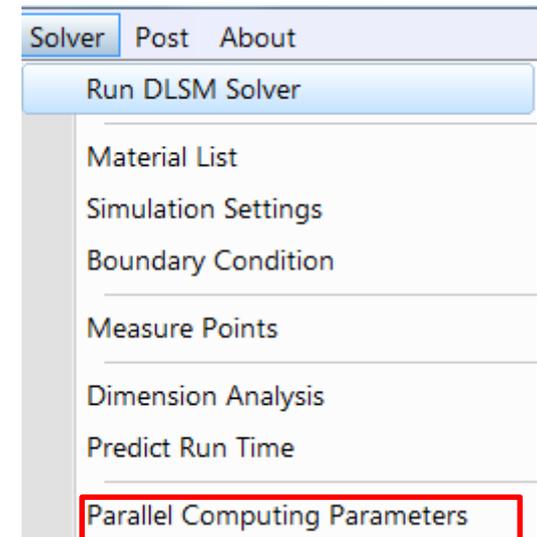
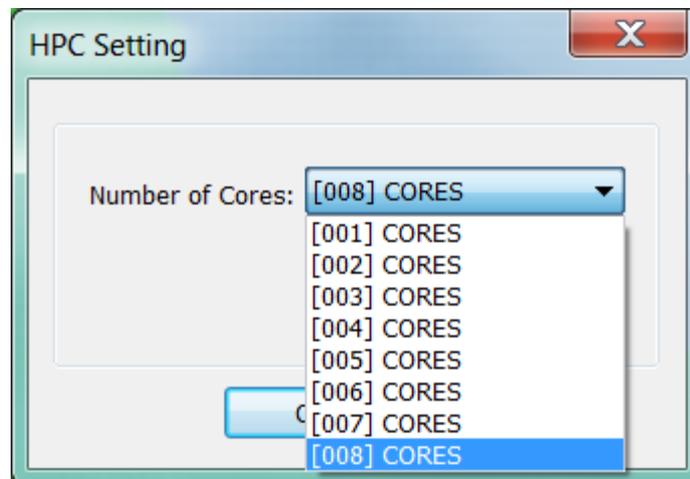
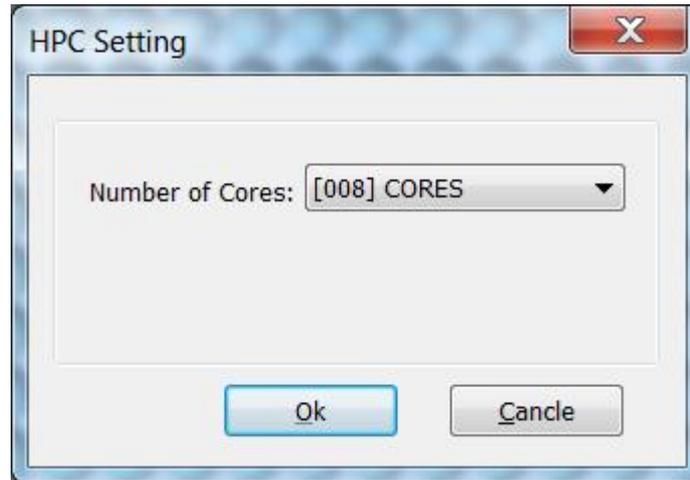
Predict Run Time

Parallel Computing Parameters

Predict Computational Time



Parallel Computing





If you can't explain it simply,
you don't understand it well enough.-Albert Einstein

TO BE CONTINUED...