



**3DXpert™**

# **3DPRINTING EXERCISE**

## **User Defined Lattice Cell**

Tutorial\_V3- Updated: 14,0000,1587,751(Official)



**3D SYSTEMS®**

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In this exercise you will create your own lattice cell.

3DXpert's lattice structures are described by XML files.

The XML files are stored in 3DXpert's Data folder (C:\ProgramData\3D Systems\3DXpert\13.0\Data) inside the folder 3D\_Printing\LatticeCells

### The Structure of a lattice file

Before creating our own cell, let's look at the structure of this file:

The first row describes the standard XML version. It should always be the same:

```
<?xml version="1.0" encoding="UTF-8"?>
```

In the second row, you describe the cell's name and its unique ID. The ID should be created as a GUID or UUID.

A GUID (global unique identifier) is a term used by Microsoft for a special number that is used as an identifier in computer programming.

You can create such numbers here, for example:

<https://www.guidgenerator.com/online-guid-generator.aspx>

So the second row should look as follows (with a different number and name):

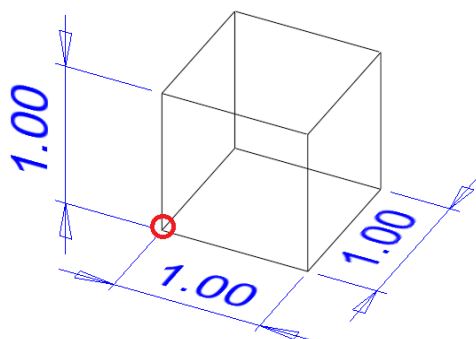
```
<Cell ID="{AC1F3D42-23BA-49B2-8DD7-6D94C173177E}" Name="Diamond">
```

Note that the name you put here is the name you will see in 3DXpert's Lattice cell selection dialog.

The core of the file consists of two sections: Nodes and Connectors.

The nodes section contains all the information for lattice nodes (the spheres in the lattice).

To do that, imagine a box with the dimensions of 1X1X1 and consider that the origin of the box is at the lower left front corner.

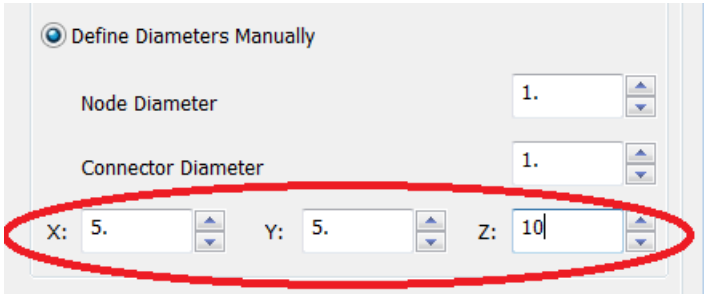


So we will add a row for each node, which includes the node id and the X,Y,Z coordinates for this node inside that box, for example:

`<Node ID="5" X=".5" Y=".5" Z="1"/>`

The first ID is always "0".

Note that you will be able to stretch the box in any direction when you define the actual lattice – see image below - so this line actually defines the distance relations between the points.



The image shows a software interface for defining diameters manually. It has two sections: 'Node Diameter' and 'Connector Diameter', both with a value of 1. Below these are three coordinate fields: 'X: 5.', 'Y: 5.', and 'Z: 10'. These three fields are circled in red, indicating they are the focus of the discussion.

The Connectors section defines the connectors (the pipes connecting the spheres).

Each connector's row is practically the connector link between each two spheres that are connected (referring to the IDs defined in the nodes section)

For example:

`<Connector Link="2-5"/>`

The following page includes an example description of a lattice cell.

```

<?xml version="1.0" encoding="UTF-8"?>
<Cell ID="{AC1F3D42-23BA-49B2-8DD7-6D94C173177E}" Name="Diamond">
  <Nodes>
    <Node ID="0" X="0" Y="0" Z=".5"/>
    <Node ID="1" X="1" Y="0" Z=".5"/>
    <Node ID="2" X="1" Y="1" Z=".5"/>
    <Node ID="3" X="0" Y="1" Z=".5"/>
    <Node ID="4" X=".5" Y=".5" Z="0"/>
    <Node ID="5" X=".5" Y=".5" Z="1"/>
    <Node ID="6" X=".5" Y=".5" Z=".5"/>
    <Node ID="7" X="0" Y="0" Z="0"/>
    <Node ID="8" X="1" Y="0" Z="0"/>
    <Node ID="9" X="1" Y="1" Z="0"/>
    <Node ID="10" X="0" Y="1" Z="0"/>
    <Node ID="11" X="0" Y="0" Z="1"/>
    <Node ID="12" X="1" Y="0" Z="1"/>
    <Node ID="13" X="1" Y="1" Z="1"/>
    <Node ID="14" X="0" Y="1" Z="1"/>

  </Nodes>
  <Connectors>
    <Connector Link="0-7"/>
    <Connector Link="1-8"/>
    <Connector Link="2-9"/>
    <Connector Link="3-10"/>
    <Connector Link="0-5"/>
    <Connector Link="1-5"/>
    <Connector Link="2-5"/>
    <Connector Link="3-5"/>
    <Connector Link="0-4"/>
    <Connector Link="1-4"/>
    <Connector Link="2-4"/>
    <Connector Link="3-4"/>
    <Connector Link="0-11"/>
    <Connector Link="1-12"/>
    <Connector Link="2-13"/>
    <Connector Link="3-14"/>
    <Connector Link="4-6"/>
    <Connector Link="5-6"/>

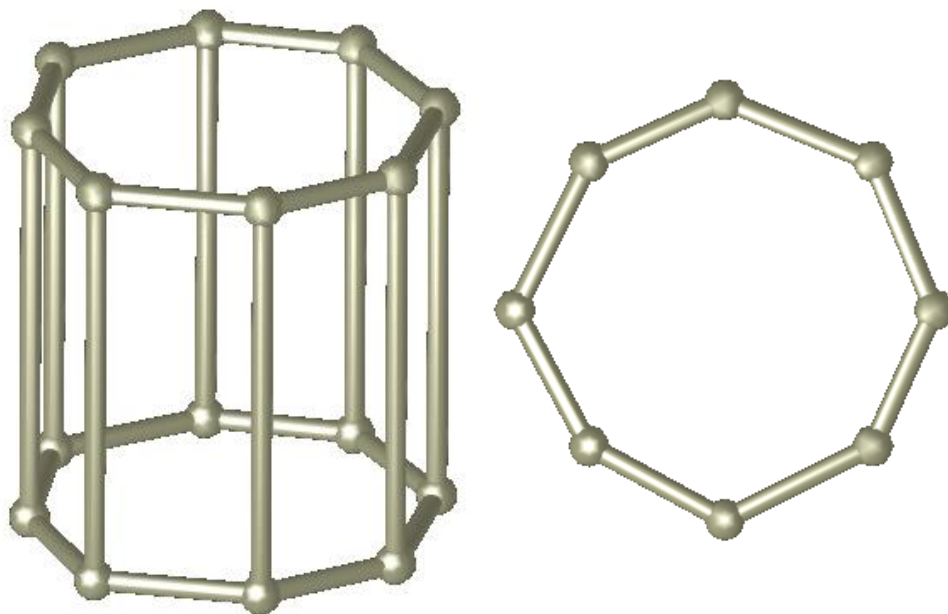
  </Connectors>
</Cell>

```

## Create your own lattice cell

We will now create our own lattice cell. Note: this cell is fictive and used here only as a guide to creating your own cells.

Let's suppose that our own lattice cell will look like the one shown here:



It resembles a simple cylinder but is actually a polygon with 8 segments.

Note: Keep in mind that the origin of the virtual 1x1x1 box is at the lower left front corner.

1. The easiest way to start, in order to have already a predefined structure of the XML file, is to make a copy of an existing structure.
2. Enter the directory **C:\ProgramData\3D Systems\3DXpert\14.0\Data\3D\_Printing\LatticeCells** and copy any the existing XML files and rename the copy as "MyLattice"
3. Edit the XML (Right mouse click→Edit should open it up with WordPad). Let's change its Cell ID and Name. Generate the Cell ID by using the link from the explanation above. Change the name to "MyLattice" (Name="MyLattice"). As mentioned above, this is the name, which will be shown in the Lattice dialog cell selection list.
4. Remove all the existing rows with the Node ID's except of the first one. Modify its X, Y and Z values with one of the new positions.

In our example, start at a certain quadrant, for example at 3 o'clock.

Its position will be X=1, Y=0.5, Z=0.

Copy & paste this row 8 times and move on, i.e. clockwise, with the nodes' definition.

While the X & Y values change for each node, the Z value remain "0".

Node ID	X	Y	Z
0	1	0.5	0

1	0.853	0.853	0
2	0.5	1	0
3	0.176	0.853	0
4	0	0.5	0
5	0.176	0.176	0
6	0.5	0	0
7	0.853	0.176	0

5. So now that we have the 8 lower nodes, just copy & paste of all these 8 rows and change the Z values of the copied cells from "0" to "1".

We are done with the definition of all the nodes needed for this structure.

6. Let's define now the connectors.  
Delete all the original rows in this file with the connector links except for the first one and modify it so the first connector will connect node "0" and node "1":  
Connector Link="0-1".

Define the rest of connections between the nodes.

First Group Horizontal Bottom	Second Group Horizontal Top	Third Group Vertical
0-1	8-9	0-8
1-2	9-10	1-9
2-3	10-11	2-10
3-4	11-12	3-11
4-5	12-13	4-12
5-6	13-14	5-13
6-7	14-15	6-14
7-0	15-8	7-15

Note that you need 8 horizontal connectors at the bottom, 8 horizontal connectors at the top and 8 vertical connectors between bottom and top.

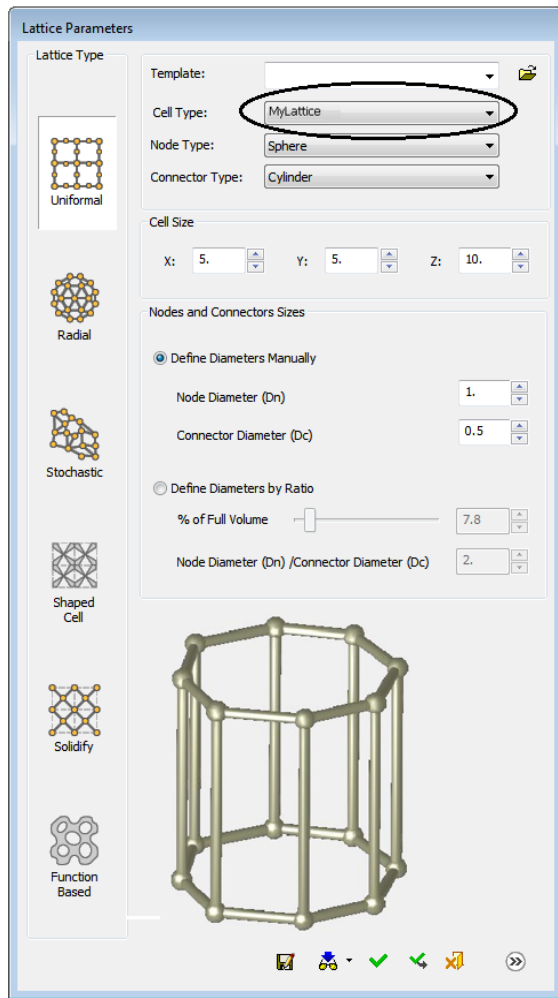
Save and close the XML file.

7. You can also assign an image to the lattice, which can describe the structure or be used as a preview of the lattice when selecting the cell.

We will use in this exercise the file "MyLattice.jpg". Place it in the same folder, where the XML file is located.

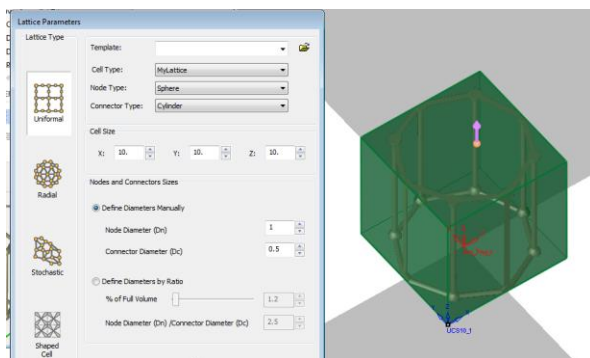
8. In 3DXpert enter Lattice and notice that the cell called “MyLattice” now through the dropdown list. You can apply this lattice to any object you like.

available



## Assign the new Lattice

9. Open up a **new 3DPrint project** and add the file “**Box 10x10x10.elt**” to the project.
10. Assign the lattice to the object and define in the dialog Lattice a cell size of 10 x 10 x 10. The result is exactly one cell of your lattice, since the object has the same size.



End of Exercise.