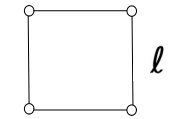
Truss Mechanics

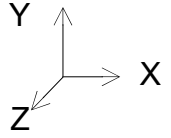
3D Exponential Lattice Truss Beams

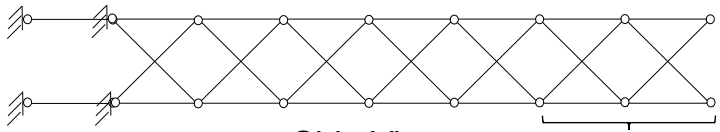
LATTOGLE ™

3D Cantilevered Soft Lattice Truss Beam Geometry



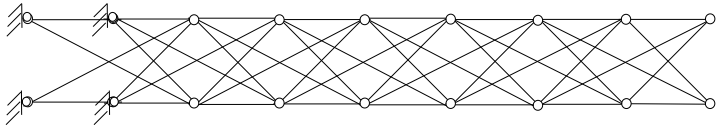
Front View



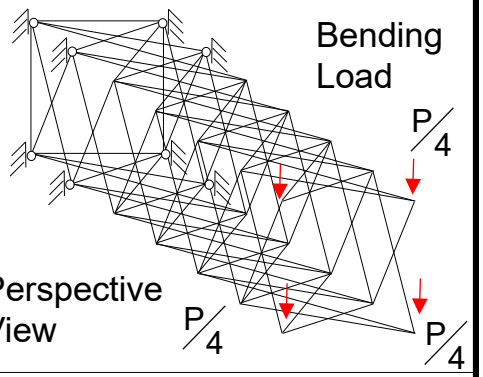


Side View

Repeating unit = n



Top and Bottom View



Numerical Bending Deflection Expression

$$Y(n) = \frac{P\,\ell}{EA}\left[\frac{\sqrt{2}}{4}\left[(\sqrt{3}/48)\times \mathrm{Sinh}[5.2678\,n] + (n)\times \mathrm{Cosh}[2.6339\,n] + (1/4)\times \mathrm{Cosh}[2.6339\,n] + (\sqrt{3}/3)\times \mathrm{Sinh}[2.6339\,n] + (2)\times n^3 - (3/2)\times n^2 + (5/16)\times n - (1/4)\right] + \frac{5\sqrt{5}}{8}\left[(1/64)\times \mathrm{Cosh}[5.2678\,n] + (\sqrt{3}/96)\times \mathrm{Sinh}[5.2678\,n] + (n)\times(3/4)\times \mathrm{Cosh}[2.6339\,n] + (n)\times(\sqrt{3}/4)\times \mathrm{Sinh}[2.6339\,n] - (\sqrt{3}/8)\times \mathrm{Sinh}[2.6339\,n] + (2)\times n^3 + (3/2)\times n^2 + (3/16)\times n - (1/64)\right]\right]$$

Bending to Axial Coupling Terms

Linear Terms

Isolated strain values per unit (E = A = 1)		
Unit	$\sqrt{2}$ Short members	$\sqrt{5}$ Long members
1	1	0
2	9	16
3	105	256
4	1425	3616
5	19793	50431

Notice the dramatic increase in strain values as the number of truss units increase. This factor leads to an exponential bending displacement expression.

Exponential displacement equation for a 3D cantilevered soft truss beam with a bending end load.