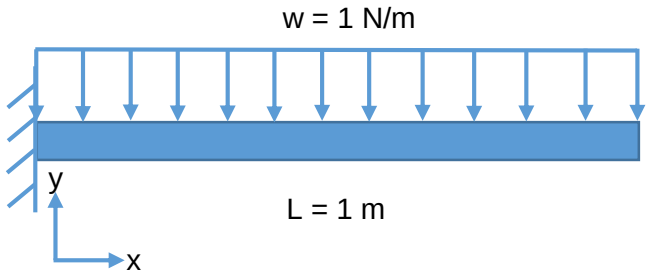
Structural FEM Code Verification

Cantilever Beam Bending

Case: A uniform cross section beam of length L with Young's Modulus E and Moment of Inertia around bending axis I under applied uniform distributed load, w. What is the maximum deflection at the tip of the beam?



E = 70 MPa

I = 5.207x10^{-7} m^4

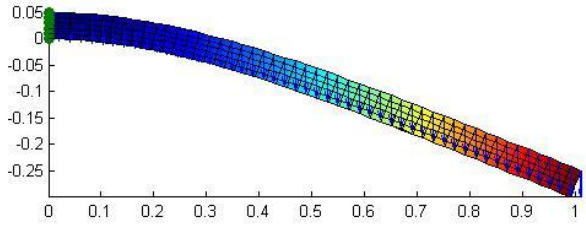
Analytical Solution

From Shigley's Beam Tables, $y_{max} = \frac{-wL^4}{8EI}$

Numerical Solution

The model consists of 50x5x5 hexahedral elements with a total dimension of 1mx0.05mx0.05m. Nodal loads are distributed and applied on the top surface. The fixed end are applied a boundary condition of displacements = 0 in x, y and z.

The code assembles the stiffness matrix by integration of order 2. [K]{U}={F} is solved using direct matrix inversion.



	Theory	Code
Displacement	3.428mm	3.215mm
Percent Error	0%	6.2%