**APL405 (Machine Learning in Mechanics) | Lab – 7 |**

**Physics Informed Neural Network**

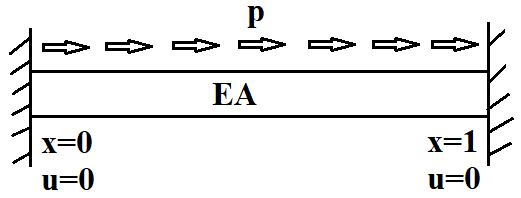
**Assignment**

1. Solve an Inverse problem (Data driven Identification): A 1-dimensional bar is clamped on both ends. The governing equation is represented by,

is the domain with,, . The deflection over the whole domain is known and given by,

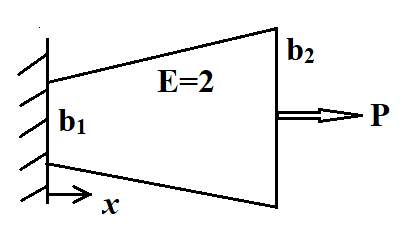
The distributed load over the whole domain can be given by,

Using a Neural Network find the stiffness coefficient at 100 points uniformly distributed over the whole domain and plot vs . Also plot the cost function history with epochs as shown in the class.



Note: The neural network will have two inputs and . Output will be . Also, the boundary conditions have no influence over the learning of model parameters.

1. Change the forward problem code shown in the class for a tapered bar problem with Neumann Boundary condition:



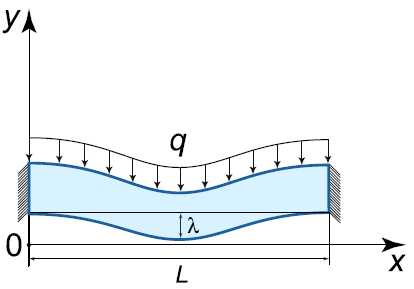
Breadth of the bar at clamped end and breadth at the free end is . The length(*L*) and the width(*t*) are both 1 (unity). Young’s modulus E is 2 units. The concentrated point load at the free end units. Predict the displacement over 50 points uniformly distributed over the domain . Plot vs and cost history (total cost, boundary condition loss, Neumann condition loss and differential equation loss) vs epochs.

Note: Neumann condition is given in case of a bar problem as .

1. Predict the vertical displacement (*y*) in case of a Euler-Bernoulli beam.The governing equation is represented by,

A clamped-clamped boundary condition can be stated as,

, , , .



Assume *L*, *E*, *I* and *q* as 1(unity). Through the prediction of a neural network, plot y at 100 sample points in the domain. Also plot cost function history for different losses (total, boundary and differential equation loss).