# Project: APL405 - Machine Learning in Mechanics

Total Marks: 30

**Deadline**: Sunday, May 5, 2025 on or before 11 PM.

**Submission**: You need to submit your code files and presentation file on Moodle.

**Late Submission**: 50 % of the marks will be deducted for any submission beyond the deadline. No submissions will be accepted after two days past the deadline.

**Collaboration**: Collaboration in a pair of maximum two students is allowed.

**Problem Statement**: The setup of the crack branching problem, which has been studied previously by different researchers is given in Fig. 1.
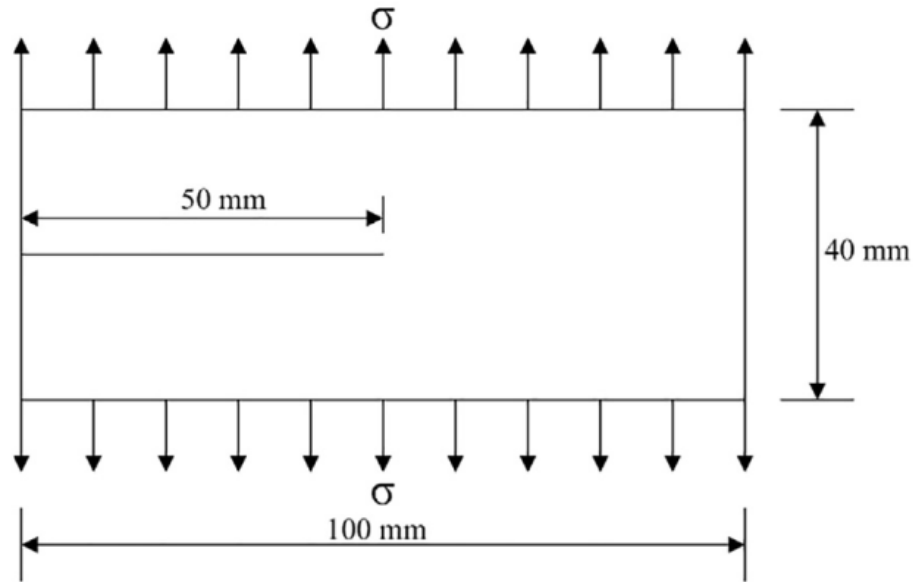


Figure 1: Setup of pre-notched plate under tensile loading

A 100 mm length and 40 mm width glass plate with a 50 mm notch is under $\sigma = 1$ MPa tensile loading at its boundaries. The material parameters used are given in Table 1.

The crack propagation path with different notch lengths and notch locations (measurement is done from the left hand corner) are provided in the data file (Link provided on Moodle). Files inside the input folder (within data folder) denotes the initial configuration of the plate

Table 1: Parameters for pre-notched plate under tensile loading

| Parameter | Material Proerties | | | | Discretization | | Artificial Viscosity | |
| | $\rho$ $(kg/m^3)$ | $E$ (GPa) | $\nu$ | $\epsilon_{max}$ | $\Delta p$ (mm) | $h$ (mm) | $\beta_1$ | $\beta_2$ |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Value | 2450 | 32 | 0.2 | 0.000509 | 0.125 | 0.250 | 1.0 | 1.0 |

whereas files inside the output folder (within data folder) denotes the final configuration of the plate after crack propagation.

Develop a model (Machine Learning) that can predict the plate's final crack path for any initial notch length and location. You are free to choose the model. All the material and loading conditions remains same for all the cases.