National Taiwan University **Finite Element Method**

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Lab Assignment 10, 05/25/2017, 1800 -- 2000

Due 2000

Lab Grading Policy: Attendance 20%, Score 80%, Bonus 40%

In case you have difficulty in finishing the exercises on time, you should upload them before **2100 on Saturday** and a penalty of 20% discount will be applied on your score. No late submission after 2100 on Saturday is permitted. We will in general post the reference solutions **by Sunday**.

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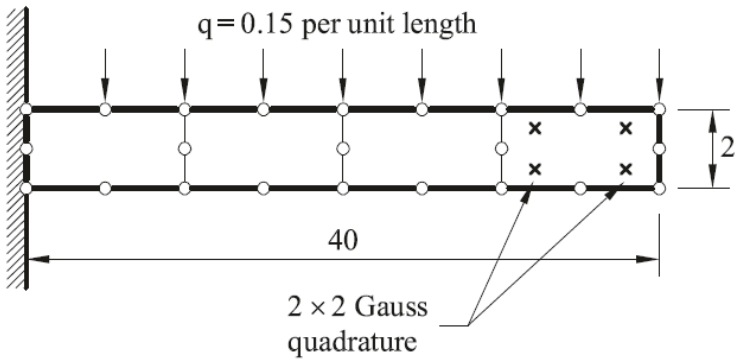
1. (40%) Consider a plate subjected to a distributed load shown below. Let the length unit equal to meter, Young's modulus $E = 3\times10^7$ Pa, Poisson's ratio $\nu = 0.3$ and thickness = 1 m. Plane stress conditions are considered.



Compute the tip displacements at the right edge and report the results using the full (3x3) and reduced (2x2) integration rules using the Q8 elements.

```
* Q8
x-coor  y-coor        Ux            Uy
  40       0    -7.855e-005    -2.316e-003
  40       1     2.905e-008    -2.316e-003
  40       2     7.861e-005    -2.316e-003

* Q8R
x-coor  y-coor        Ux            Uy
  40       0    -7.846e-005    -2.344e-003
  40       1     2.981e-008    -2.344e-003
  40       2     7.851e-005    -2.344e-003
```

2. (40% + Bonus 40%) Evaluate element stiffness matrix with the reduced integration scheme. Calculate the shear force distribution **by integrating the shear stresses across the beam thickness**. While computing the shear stress, do two variants: (a) reduced integration for element stiffness matrix with stress computed directly from pointwise ξ and η within the

element without extrapolation and (b) reduced integration for element stiffness matrix with stress extrapolation from 2x2 Gauss points. Below is a sample plot and observe those from the extrapolation matches the exact solution quite well.