Assignment no 4

SEE609: Mathematical and Computational Tools for Engineering

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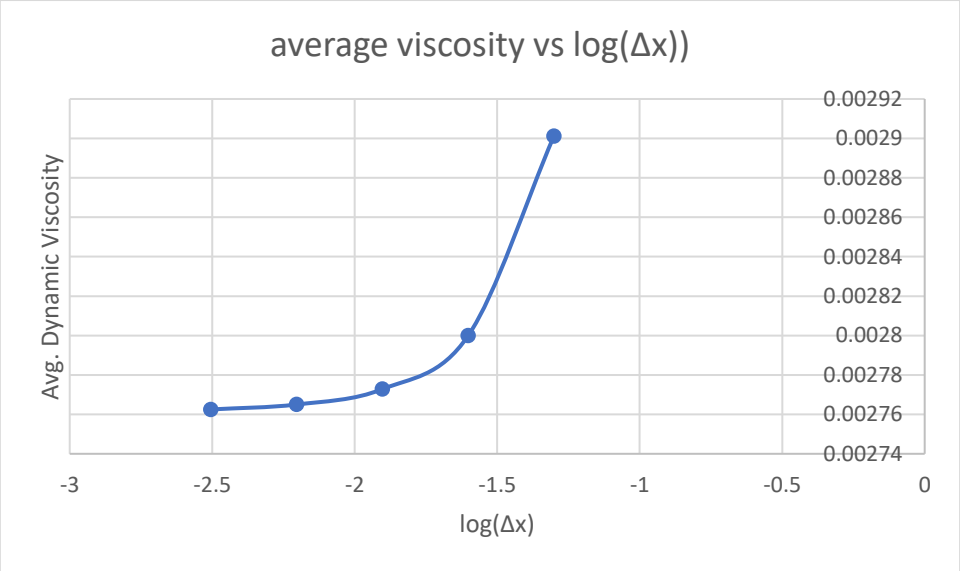
**Que 1:**

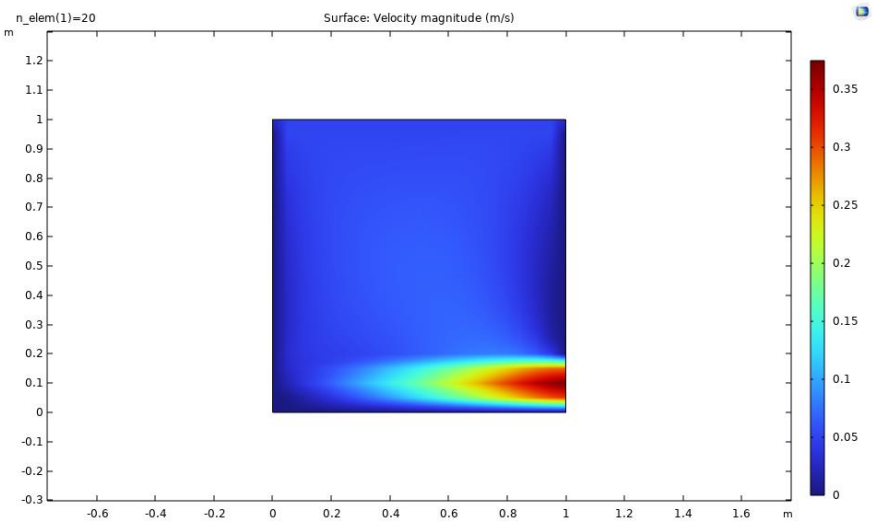
| No of element | Log(Δx) | Avg Dynamic viscosity |
|---|---|---|
| 20 | -1.30103 | 0.002901 |
| 40 | -1.60206 | 0.0028 |
| 80 | -1.90309 | 0.002773 |
| 160 | -2.20412 | 0.002765 |
| 320 | -2.50515 | 0.002763 |

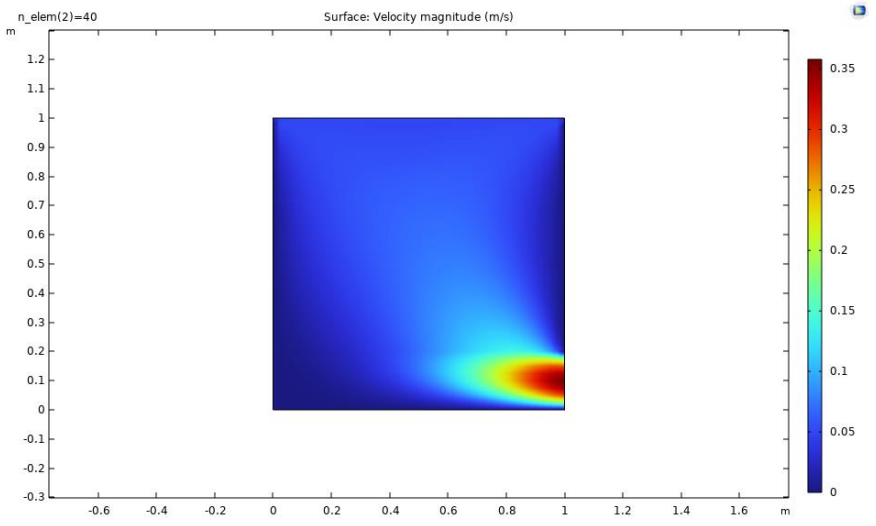


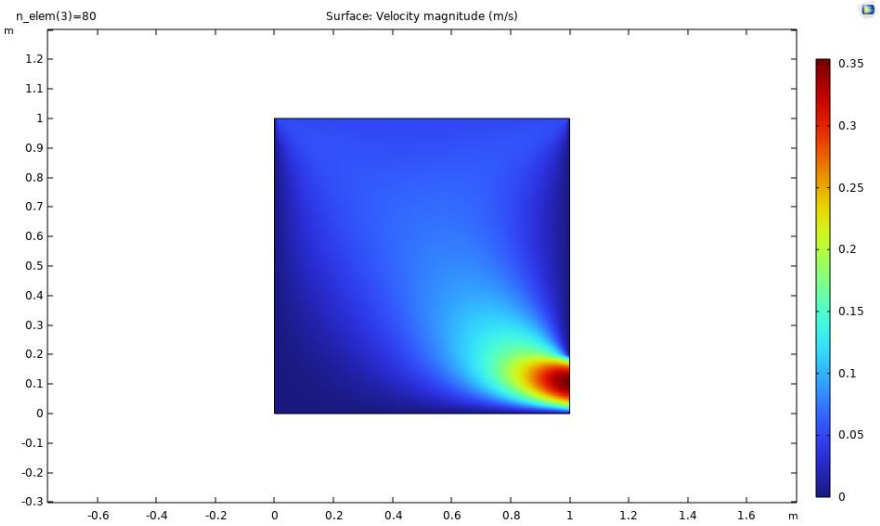

Comment on Grid Independence:

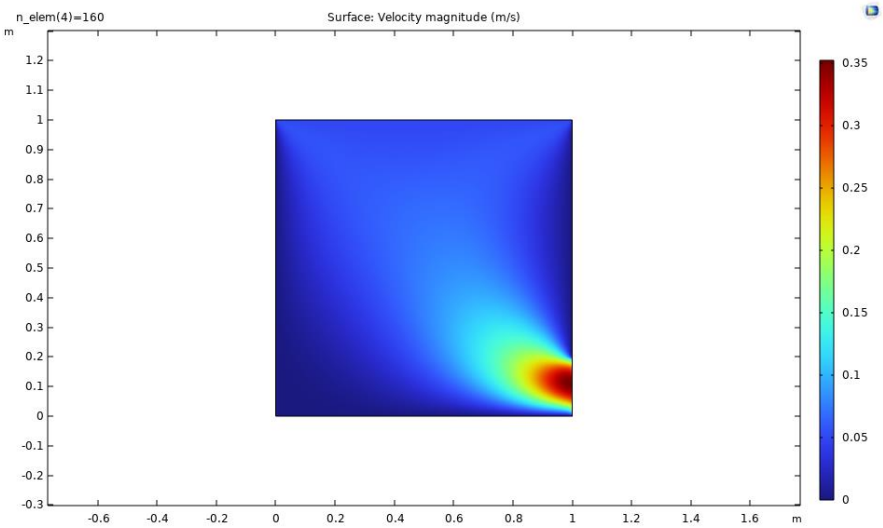
From above graph, we can see that as we are increasing the number of elements (n) the change in average viscosity is reducing. But after some value of n, the change in viscosity will be insignificant, hence after that there is no need of further increasing the value of ‘n’. This way we can achieve grid independence, and, in our case, it is near about 320.

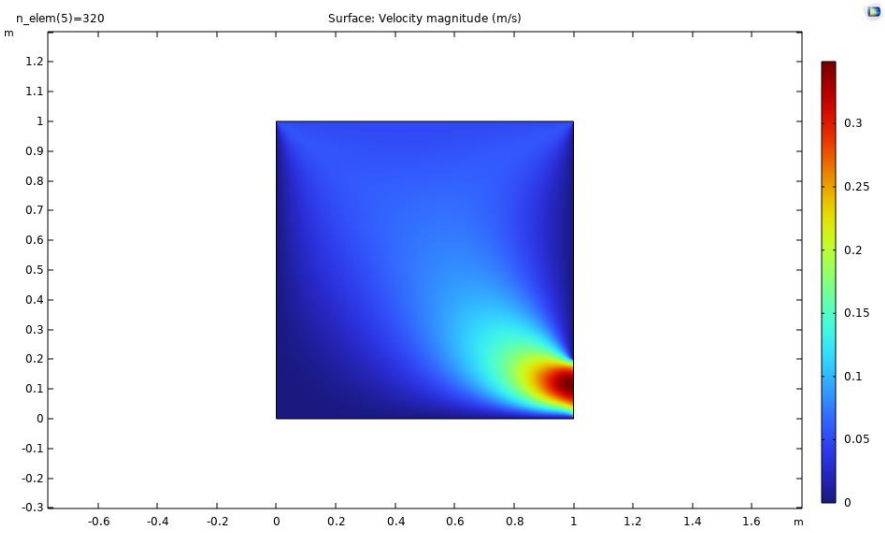
## Que 2: Velocity plots



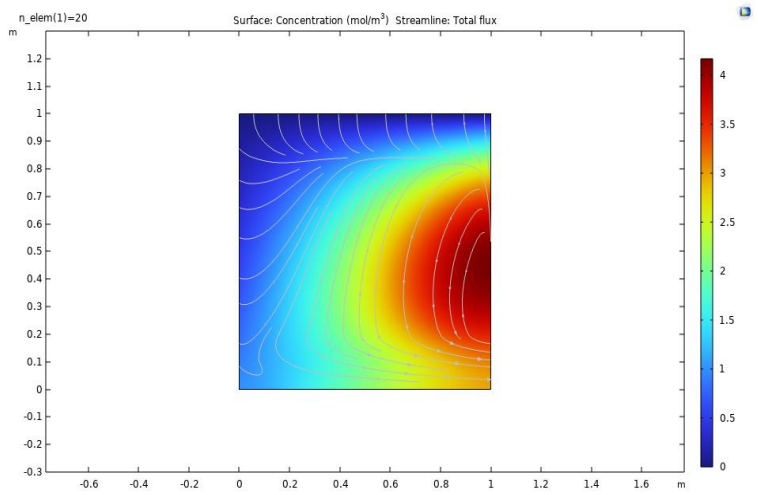


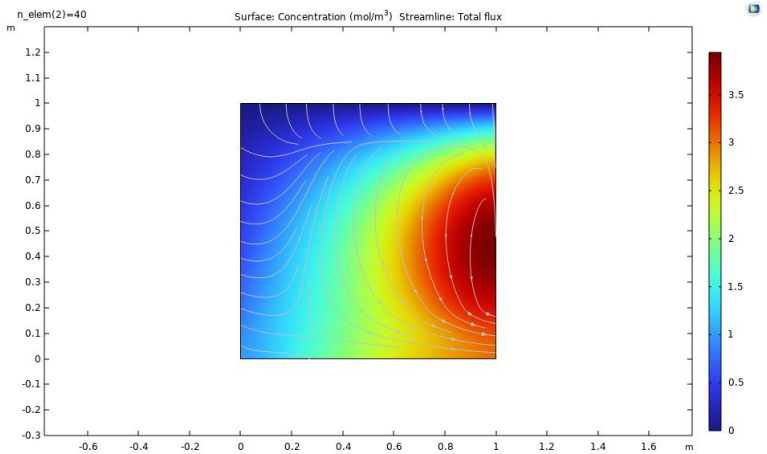



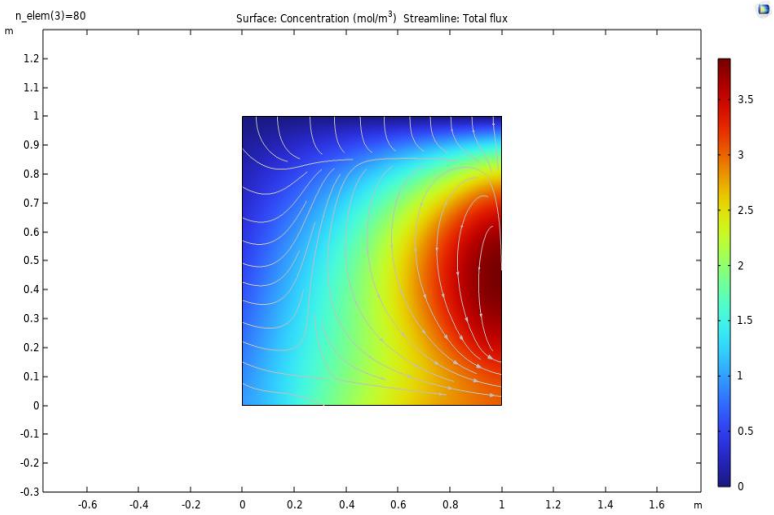

Reason for increased velocity:

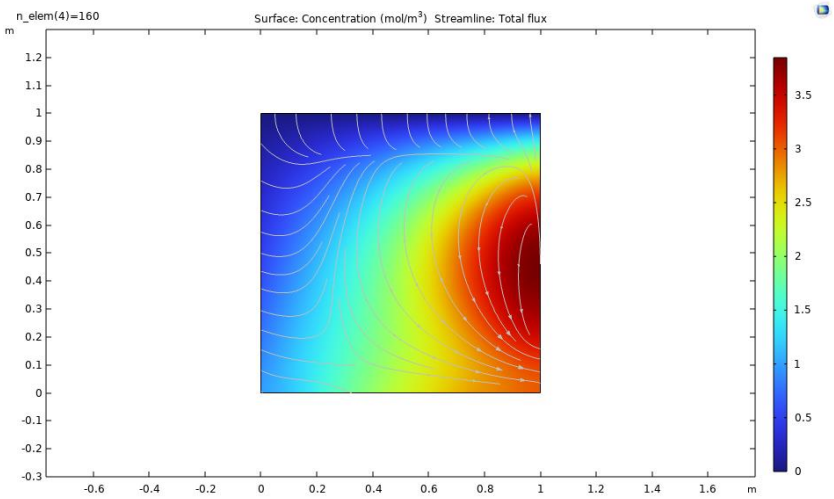
The velocity increases near the outlet due to the conservation of mass and the narrowing effect from boundary conditions. This creates higher velocities as the fluid exits, a common behavior in constrained flows.

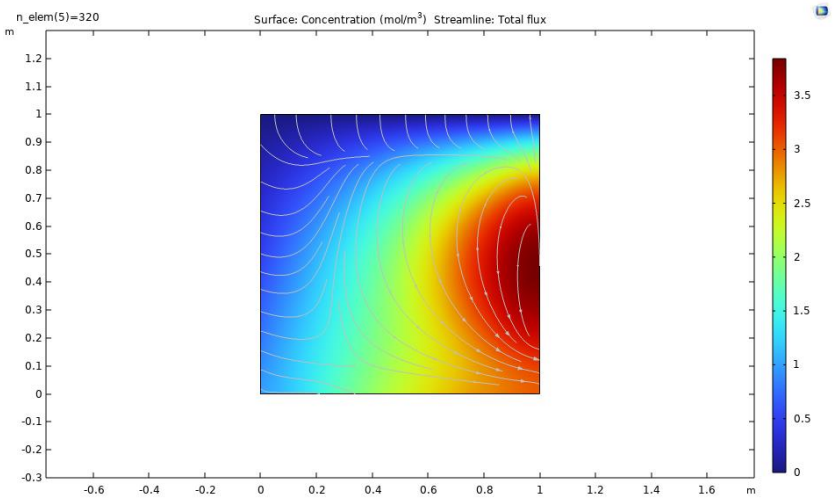
## Que 3: Concentration plots






| Number of elements (n) | Max. Concentration |
|---|---|
| 20 | 4.17 |
| 40 | 3.94 |
| 80 | 3.87 |
| 160 | 3.85 |
| 320 | 3.84 |

Reason for increasing concentration:

Due to the boundary condition on the left wall, inlet velocity from the top wall and exit from the right wall, the concentration will naturally diffuse or advect towards the right. Fluid flow will carry the concentration field from left to right, diffusion will cause the concentration to increase in that direction.