

# 3D Steady Diffusion - Verification & Validation

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[Problem Specification](#)

[1. Pre-Analysis & Start-Up](#)

[2. Geometry + Mesh](#)

[3. Model Setup](#)

[4. Numerical Solution](#)

[5. Numerical Results](#)

[6. Verification & Validation](#)

## Verification & Validation

### Verification

The first thing we check for verification is the analytical solution since we have one available. Then, we do a mesh refinement and use a smaller pseudo-time-step to check whether the results are consistent with the original calculation. By using a finer mesh and a smaller pseudo-time-step, we investigate the effects of truncation error caused by spatial discretization and temporal discretization. Then we will do a case comparison for the results obtained after spatial and temporal refinement.

### Analytical Solution

The analytical solution is contained in [this csv file](#) that contains the concentration (or equivalently, the temperature) at various radial locations.

In addition, here are the analytical solutions for [alpha = 1](#) and [alpha = 3/2](#).

### Mesh Refinement & Smaller Pseudo-timestep

It is always a good habit to check that the mesh is refined enough. For example, you could use an element size that is half of what was used in the videos and compare the results.

When using pseudo-transient, it is important to make sure that you are using a small enough pseudo-time-step. For example, you could use a pseudo-time-step that is half of what is used in the videos and compare the results, or you could also use one that is twice as big as what is used in the videos.

### Validation

We do not have any experimental data for this problem.

### References:

*Under construction*

### Acknowledgement:

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