**1D unsteady diffusion equation**

**Analytical solution:**

Analytical solution is calculated using separation of variables technique. Here the dependent variable is expressed as a combination of a function of each independent variable, resulting in a system of ODE which can be solve d analytically.

Therefore, we have

And

Substituting in (1)

Equating above equation to -λ2

We get the following ODEs

General solution for first equation with imaginary roots and zero real part is given by

For the second ODE the solution is,

Therefore, the solution for u is

Using following boundary condition and initial condition

, ,

Substituting we get and writing

Substituting we get

i.e., and

The solution would be the linear combination of all values of for different values of . The unique solution is obtained by the initial condition.

Therefore

The final solution is