Transport equation

The convection-diffusion equation for the transport of temperature T is

$$\frac{\partial T}{\partial t} = -U\frac{\partial T}{\partial x} + k\frac{\partial}{\partial x}(\frac{\partial T}{\partial x}) + S \tag{1}$$

For a non existing convection case, Equation (1) becomes the diffusion Equation

$$\frac{\partial T}{\partial t} = k\frac{\partial}{\partial x}(\frac{\partial T}{\partial x}) + S \tag{2}$$

that, for a steady-state, is

$$0 = k\frac{\partial}{\partial x}(\frac{\partial T}{\partial x}) + S \tag{3}$$

These equations are solved by a Finite Volume Method (FVM) and by a Finite Difference Method (FDM).

References

1. Computational Fluid Dynamics Fundamentals Course. A. Wimshurst. 2019.

2. An Introduction to Computational Fluid Dynamics: The Finite Volume Method. H. Versteeg, W. Malalasekera. 2007.

3. Finite Difference Computing with PDEs. A Modern Software Approach. H. Langtangen, S. Linge. 2016.