# Additional Theories:

## Turbulent Schmidt number (Sct):

For a multicomponent fluid, scalar transport equations, ref Eq , are solved for velocity, pressure, temperature and other quantities of the fluid. However, additional equations must be solved to determine how the components of the fluid viz. propane mass fraction and other species are transported within the fluid. The additional turbulent transport equations which are solved for the components of fluid are of the form:

|  |  |  |
| --- | --- | --- |
|  |  | (1.1) |

where,

*U* is the fluid velocity

is the mixture density, mass per unit volume

is the conserved quantity per unit volume, or concentration

, is the conserved quantity per unit mass

is a volumetric source term, with units of conserved quantity per unit volume per unit time

is the Turbulent Schmidt number

is the kinematic diffusivity for the scalar

Since the turbulent transport of momentum, heat or mass is due to the same mechanism – eddy mixing - we expect that the value of the turbulent diffusivity is fairly close to that of the turbulent viscosity . This assumption is known as Reynolds analogy [10].Hence turbulent diffusion is expressed by . The molecular diffusion term is expressed by.

is introduced as a proportionality factor for the turbulent diffusivity, as the time scale at which the molecular diffusion occurs is different from that in the diffusion of momentum (viscosity). Generally the value of is found between 0.7 - 0.9 in most CFD software`s [23].

## Round jet anomaly:

The standard k-ε model with the standard coefficients delivers the velocity field quite accurately in two-dimensional plane jet, but large errors occur for the axisymmetric jets. Specifically, the spreading rate of round jet is overestimated by 40% [5]. The reason for this “round jet/ plane jet anomaly” is the considered mainly due to the modeled dissipation (ε) equation, refer eq(). Several modifications of constants, in the dissipation equation, have been suggested in the literature by Pope [5]. This indicates the non-generality of the model and at the same time shows non-universality of turbulence [4].