RANS Turbulence Models: Which Should I Choose?

Mojtaba Maali Amiri

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Reynolds stress turbulence (RST) models

Linear pressure-strain RST (LRST) model of Gibson-Launder

pressure-strain interaction term → $\Pi = \Pi_s + \Pi_r + \Pi_w$

Eddy viscosity turbulence models

One-equation turbulence models

Nee and Kovasznay (1968)

$$\frac{\partial \nu_t}{\partial t} + (u.\Delta)\nu_t = \text{Diffusion} + \text{Production} - \text{Destruction}$$

…y viscosity turbulence models

Two-equation turbulence models

Standard k-epsilon turbulence model

Main assumption:

The rate of production and destruction of the dissipation rate are related to the production and dissipation of the turbulence kinetic energy.

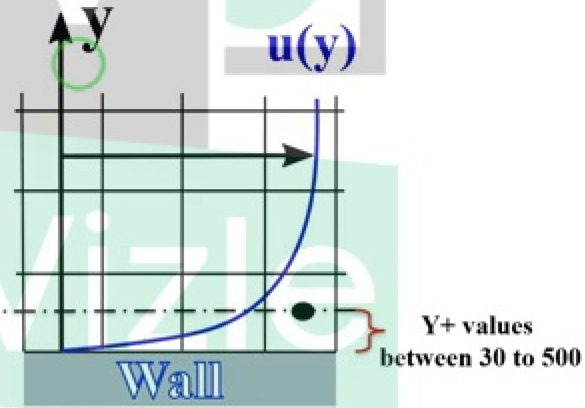
Disadvantages:

- It is known to poorly predict the separated flows.
- It is rather difficult to be integrated all the way down to the viscous sublayer.

High-Reynolds-number turbulence models (high-Y+ wall treatment):

Velocity:

$$u^{+} = \frac{1}{k}\ln(EY^{+})$$



-Reynolds-number turbulence models (low-Y+ wall treatment):

Elliptic-blending approach

y viscosity turbulence models

Two-equation turbulence models

k-omega Shear Stress Transport (SST) turbulence model

Menter (1994)