



# RANS Turbulence Models: Which Should I Choose?

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# Reynolds stress turbulence (RST) models

## Linear pressure-strain RST (LRST) model of Gibson-Lauder

pressure-strain  
interaction term

$$\Pi = \Pi_s + \Pi_r + \Pi_w$$

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 Vizle |ly viscosity turbulence models**One-equation turbulence models**

Nee and Kovasznay (1968)

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

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# 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.

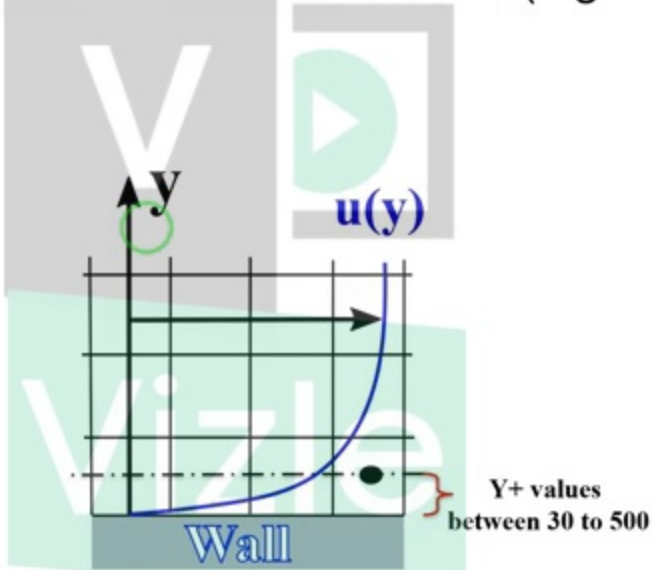
#### Disadvantages:

- 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:**

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





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Elliptic-blending approach



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# viscosity turbulence models

## Two-equation turbulence models

### k-omega Shear Stress Transport (SST) turbulence model

Menter (1994)

$$k - \epsilon$$

Region far from the wall

$$k - \omega$$

Near-wall region

Wall

The diagram illustrates the k-omega SST turbulence model. It shows a curved wall at the bottom, labeled 'Wall'. Above the wall, a dashed blue line represents the boundary of the 'Near-wall region', which is shaded in light green. This region is modeled using the k-omega model. Above the dashed line, the flow is modeled using the k-epsilon model, which is used in the 'Region far from the wall'. A vertical double-headed arrow indicates the extent of the near-wall region. A large 'V' watermark is visible in the background.





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