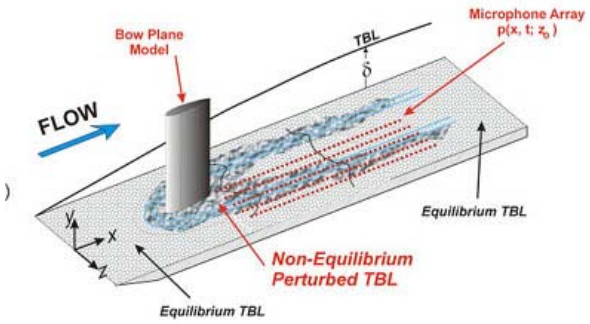
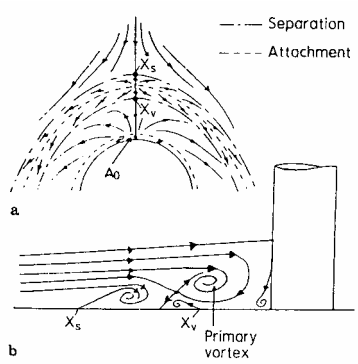
3-Dimensional Turbulent Shear Flow and Boundary Layer

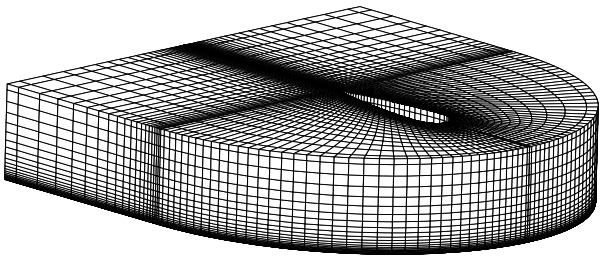
Flow Over Wing-Body Junction



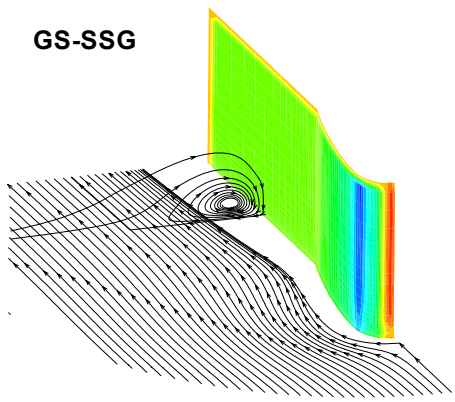


- Widely exist in the fields of airplane, submarine, turbomachinary, bridge, etc.
- Strong vortex leads to extra erosion, heat loss, vibration, noise, etc.
- Complicated turbulence physics of the flow challenges turbulence models.
- Linear k-e turbulence model fails to describe the flow.
- Nonlinear k-e models based on the explicit ASM were developed: GS-SSG and RQEVM

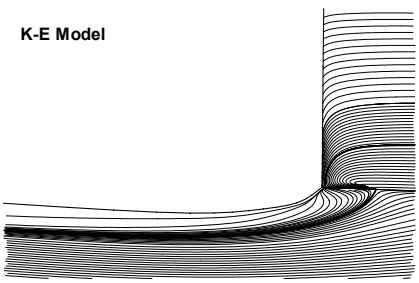
$$\overline{u_i u_j} = \frac{2}{3}\delta_{ij}k - 2\nu_t\left[S_{ij} + \beta_2\frac{k}{\varepsilon}(S_{ik}W_{kj} + S_{jk}W_{ki}) - \beta_3\frac{k}{\varepsilon}(S_{ij}^2 - \frac{1}{3}\delta_{ij}S_{kk}^2) + \beta_4\frac{k}{\varepsilon}(W_{ij}^2 - \frac{1}{3}\delta_{ij}W_{kk}^2)\right.$$
$$\left. + \beta_5\left(\frac{k}{\varepsilon}\right)^2\left(S_{ik}^2W_{kj} - W_{ik}S_{kj}^2\right) + \beta_6\left(\frac{k}{\varepsilon}\right)^2\left(S_{ik}W_{kj}^2 + W_{ik}^2S_{kj} - \frac{2}{3}\delta_{ij}S_{lk}W_{kl}^2\right)\right]$$



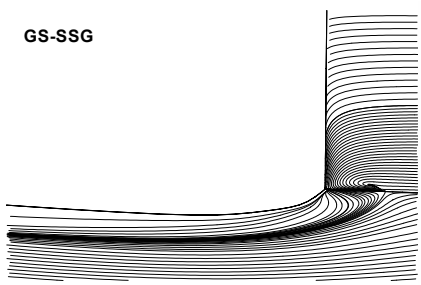
GS-SSG

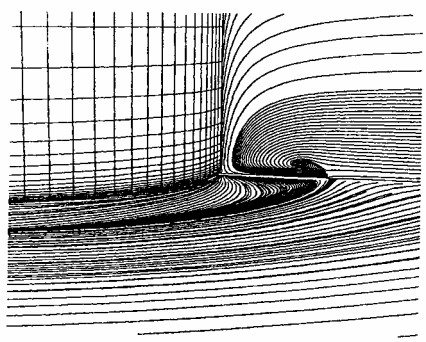


K-E Model



GS-SSG





Second-Moment Closure