Equations of motion of the dispersed phase

• Lagrangian approach for the dispersed phase :

$$\frac{d}{dt} \begin{bmatrix} u_P \\ v_P \end{bmatrix} = K_M Re_P \left(C_W(Re_P) \begin{bmatrix} u_F - u_P \\ v_F - v_P \end{bmatrix} + C_M(\sigma) \begin{bmatrix} v_F - v_P \\ -(u_F - u_P) \end{bmatrix} \right)$$
$$+ \frac{\rho_P - \rho_F}{\rho_P + \frac{1}{2}\rho_F} \begin{bmatrix} g_x \\ g_y \end{bmatrix}$$

$$K_{M} = \frac{3}{4} \frac{\nu \rho_{F}}{(\rho_{P} + \frac{1}{2}\rho_{F}) d_{P}^{2}} \qquad Re_{P} = \frac{d_{P} v_{rel}}{\nu}$$
$$\sigma = \frac{1}{2} \frac{d_{P} (\Omega - \omega)}{v_{rel}} \qquad v_{rel} = \sqrt{(u_{F} - u_{P})^{2} + (v_{F} - v_{P})^{2}}$$

- $C_W = C_W(Re_P)$ obtained from correlations by Morsi/Alexander
- $C_M = (0.4 \pm 0.1) \sigma$ for $|\sigma| \le 1$; $C_M \equiv (0.4 \pm 0.1)$ for $|\sigma| < 1$
- Source terms in the Navier–Stokes equations due to momentum transfer between phases (PSI–cell model by C.T. Crowe) :

$$S_{u_{i}}^{P} = -\frac{1}{V_{ij}} \sum m_{P} \dot{N}_{P} \left[u_{Pi,out} - u_{Pi,in} - g_{i} \left(\frac{\rho_{P} - \rho_{F}}{\rho_{P} + \frac{1}{2}\rho_{F}} \right) \left(t_{out} - t_{in} \right) \right]$$

• Lagrangian stochastic–deterministic turbulence model (LSD or discret eddy model) as proposed by Sommerfeld, Schönung, Milojević

Parallel CFD '96 Comparison of Parallelization Methods for Lagrangian Calculations of Disperse Multiphase Flows Dr. Th. Frank, Technical University Chemnitz–Zwickau, Germany

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