**multiphase flow**  - is the simultaneous flow of materials with two or more thermodynamic phases

A **fluidized bed** is a physical phenomenon that occurs when a solid particulate substance is under the right conditions so that it behaves like a fluid.

The **kinetic theory** of gases is a simple, historically significant classical model of the thermodynamic behavior of gases, with which many principal concepts of thermodynamics were established. The model describes a gas as a large number of identical submicroscopic particles (atoms or molecules), all of which are in constant, rapid, random motion. Their size is assumed to be much smaller than the average distance between the particles.

The **VOF model** (Volume of Fluid ) is a surface-tracking technique applied to a fixed Eulerian mesh.

The **Stokes number** can be defined as the relation between the particle response time and the system response time

1. what is this chapter about?

This chapter discusses the general multiphase models that are available in ANSYS Fluent

1. what physical phases substances exist?

Physical phases of matter are gas, liquid, and solid.

1. What regimes are gas-liquid or liquid-liquid flows exist?

Bubbly flow: This is the flow of discrete gaseous or fluid bubbles in a continuous fluid.

Droplet flow: This is the flow of discrete fluid droplets in a continuous gas.

Slug flow: This is the flow of large bubbles in a continuous fluid.

Stratified/free-surface flow: This is the flow of immiscible fluids separated by a clearly-defined interface.

1. What regimes are gas-solid flows exist?

Particle-laden flow: This is flow of discrete particles in a continuous gas.

Pneumatic transport: This is a flow pattern that depends on factors such as solid loading, Reynolds numbers,and particle properties. Typical patterns are dune flow, slug flow, and homogeneous flow.

Fluidized bed: This consists of a vessel containing particles, into which a gas is introduced through a distributor. The gas rising through the bed suspends the particles. Depending on the gas flow rate, bubblesappear and rise through the bed, intensifying the mixing within the bed.

1. What regimes are gas-solid flows exist?

Slurry flow: This flow is the transport of particles in liquids. The fundamental behavior of liquid solid flows varies with the properties of the solid particles relative to those of the liquid. In slurry flows, the Stokes number (see Equation 17.4 (p. 471)) is normally less than 1. When the Stokes number is larger than 1, the characteristic of the flow is liquid-solid fluidization.

Hydrotransport: This describes densely-distributed solid particles in a continuous liquid.

Sedimentation: This describes a tall column initially containing a uniform dispersed mixture of particles.At the bottom, the particles will slow down and form a sludge layer. At the top, a clear interface will appear, and in the middle a constant settling zone will exist.

1. Where does the slug flow can occur?

Slug flow examples include large bubble motion in pipes or tanks.

1. Does slurry flow is an gas-Solid or liquid-Solid flow ?

liquid-Solid

1. How many approaches for the numerical calculation of multiphase flows does exist?

Currently there are two approaches for the numerical calculation of multiphase flows: the Euler-Lagrange approach (discussed in Introduction (p. 373)) and the Euler-Euler approach

1. How many different Euler-Euler multiphase models are available in ANSYS ?

three different Euler-Euler multiphase models are available: the volume of fluid (VOF) model, the mixture model, and the Eulerian model.

1. Why is the Stokes number important?

For systems with intermediate particulate loading, estimating the value of the Stokes number can help you select the most appropriate model.

1. Is it possible to apply any of three methods with a Stokes number equal to one?

Yes it is

1. What are higher-order spatial and time discretization schemes necessary for?

In order to accurately model multiphase flow, both higher-order spatial and time discretization schemes are necessary

1. Is it possible to use the second-order time scheme with VOF ?

The second-order time scheme cannot be used with the VOF

1. Why is it important to set the correct initial field?

When solving a time-dependent problem, a proper initial field is required to avoid instabilities, which usually arise from poor initial field

1. Multiphase coupled solver is iterative, isn’t it?

yes it is

In this chapter, the authors discuss the general multiphase models that are available in ANSYS Fluent. The mixture model, the volume of fluid model and the Euler model are considered and compared.

First, the author indicates the main types of multiphase flow. The following are typical examples and explanations for them. After that, the application of these flows to real phenomena is discussed. For instance, slug flow examples include large bubble motion in pipes or tanks. The author discusses the problem of choosing the optimal model for modeling various flows and describes the Euler-Euler in more detail. Author singles out The VOF Model, The Mixture Model and The Eulerian Model as the main approaches. Further, the author shows which models should be chosen for certain flow regimes. For example, for slug flows, the VOF model should be used. In conclusion, the issue of convergence and stability of solutions is discussed and in which cases it is necessary to use more accurate time schemes.

The article defines the main models of fluid flow, explains the various approaches to modeling a multiphase fluid and in which cases which methods should be used

A large number of flows encountered in nature and technology are a mixture of phases. Physical phases of matter are gas, liquid, and solid, but the concept of phase in a multiphase flow system is applied in a broader sense. In multiphase flow, a phase can be defined as an identifiable class of material that has a particular inertial response to and interaction with the flow and the potential field in which it is immersed. For example, different-sized solid particles of the same material can be treated as different phases because each collection of particles with the same size will have a similar dynamical response to the flow field.