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Chemical engineering

CHE 311 Assignment

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1. classification of flows with illustration

**A. Steady and unsteady flow**

**Steady flow** refers to the flow in which the fluid properties at a point in the system do not change over time. Simply, it’s a flow in which the velocity of the fluid at a particular fixed point does not change with time. E.g. a constant discharge through a pipe



 Fig 1.0 Illustration of a steady flow

**Unsteady flow**

**UnSteady flow** refers to the flow in which the fluid properties change over time. Simply, it’s a flow in which the velocity of the fluid can differ between two points . E.g .flow through a tight pipe bend.



Fig 2.0 illustration of an unsteady flow

**B. compressible and incompressible**

**Compressible flow** refers to the fluid flow in which the fluid's density varies with the trending pressure. E.g. shock waves around sharp and blunt bodies

**Incompressible flow (isochoric flow)** refers to a flow in which the material density is constant within a fluid parcel—an infinitesimal volume that moves with the flow velocity.



Fig 3.0 illustration of compressible and incompressible flows

**C. uniform and non-uniform**

**A uniform flow** is that in which the flow parameters remain constant with distance along the flow path. E.g. flow of a liquid through a pipeline of constant diameter



 Fig 4.0 Illustration of a uniform flow

**non-uniform flow** is that in which the flow parameters vary and are different at different points on the flow path. E.g a wave travelling along a channel

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Fig 5.0 illustration of a non-uniform flow

**D. rotational and irrotational flow**

**Rotational flow** is a flow in which the fluid particles while flowing along stream lines rotate about their own axis .



Fig 6.0 illustration of a rotational flow

**Irrotational flow** is a flow in which the fluid particles while flowing along stream lines don’t rotate about their own axis.



Fig. 7.0 illustration of an irrational flow

**E. viscous and non-viscous**

**viscous flow** A type of fluid flow in which there is a continuous steady motion of the particles, the motion at a fixed point always remaining constant. The flow of the fluid is usually accompanied by much viscosity

**An inviscid flow** is the flow of an ideal fluid that’s assumed to have no viscosity.



Fig 8.0 Illustration of a viscous and an inviscid flow

F. separated and non-separated flow

A flow is said to be **separated** when the fluid flow becomes detached from the surface of the object, and instead takes the forms of eddies and vortices.



Fig 9.0 illustration of a separated flow

 **A non-separated flow** is that which doesn’t become detached from the surface of the object it comes in contact with.



Fig 10.0 illustration of a non-separated flow