SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade
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DEPARTMENT OF AEROSPACE ENGINEERING

23AST206 – AERODYNAMICS

II YEAR IV SEM

UNIT 2 – INCOMPRESSIBLE AND INVISCID FLOWS

TOPIC – SOURCE AND SINK FLOW

SOURCE AND SINK FLOW

Source and Sink Flow

➢ **Source Flow**

A radially symmetrical flow field directed outwards from a common point is called a source flow.

The central common point is the **line source** described as "A line source is a line from which fluid appears and flows away on planes perpendicular to the line".

As the fluid flows outward, the area of flow increases. As a result, to satisfy continuity equation, the velocity decreases and the streamlines spread out. The velocity at all points at a given distance from the source is the same.

Source

SOURCE AND SINK FLOW

➢Source Flow

We can derive the relation between flow rate and velocity of the flow. Consider a cylinder of unit height, coaxial with the source. The rate at which the source emits fluid should be equal to the rate at which fluid flows out of the surface of the cylinder.

$$\bar{v} = v_r(r) \cdot \hat{r}.$$

$$\therefore \quad v_r(r) = \frac{Q}{2\pi r}.$$

$$\int_S \bar{v} \cdot d\bar{S} = 2\pi r v_r(r) = Q.$$

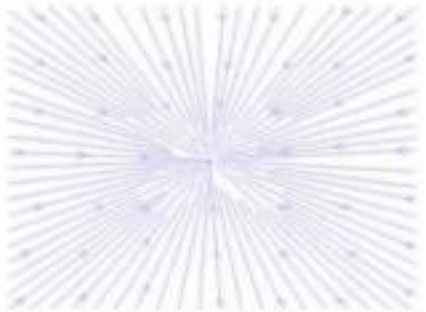
SOURCE AND SINK FLOW

➢ **Sink Flow**

Sink flow is the opposite of source flow. The streamlines are radial, directed inwards to the line source.

In order to satisfy the continuity equation, the streamlines get bunched closer and the velocity increases as we get closer to the source.

As with source flow, the velocity at all points equidistant from the sink is equal.



Sink

SOURCE AND SINK FLOW

➢ **Sink Flow**

The velocity of the flow around the sink can be given by

$$\bar{v} = -v_r(r) \cdot \hat{e}_r,$$

$$v_r(r) = \frac{Q}{2\pi r}.$$

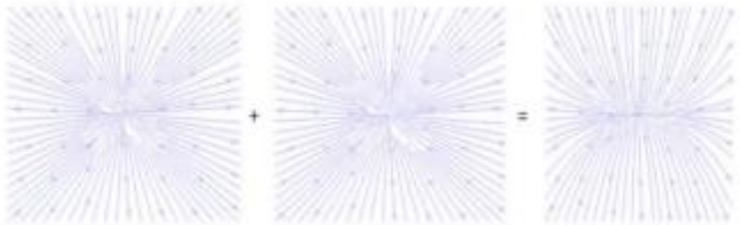
The flow around a line sink is irrotational.

➢ **Doublet**

A doublet can be thought of as a combination of a source and a sink of equal strengths kept at an infinitesimally small distance apart.

Thus the streamlines can be seen to start and end at the same point.

Modelling a doublet



Source Sink Doublet

Thank You