SNS COLLEGE OF TECHNOLOGY
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DEPARTMENT OF FOOD TECHNOLOGY

COURSE CODE & NAME: 19FTT303 & Application of Computers In Instrumentation and Process Control of Food Industry

III YEAR / V SEMESTER

UNIT : I SENSORS AND TRANSDUCERS

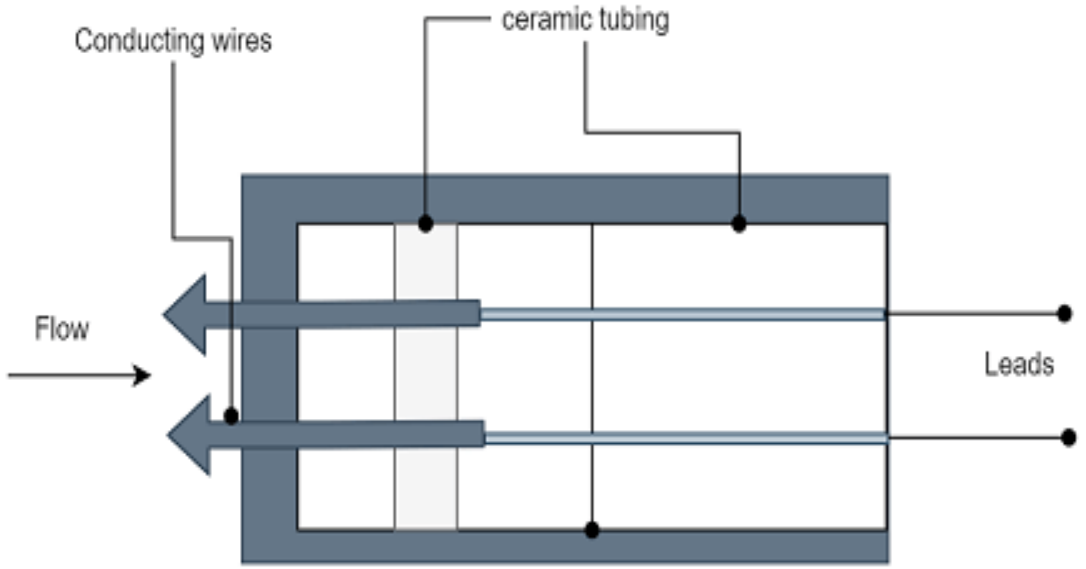
TOPIC 3 : HOT WIRE ANEMOMETER

HOT WIRE ANEMOMETER

- This is the instrument used for the calculation of fluid direction and velocity.
- This measurement is done by calculating the heat loss in the wire that is located in the liquid stream.
- These devices make use of a thin wire.
- which is usually some micrometers electrically heated up to some level of temperature almost higher the ambient temperature range.
- The usage of hot wire anemometer allows rapid flow velocity that has to be measured from the electric voltage dimensions.

PRINCIPLE

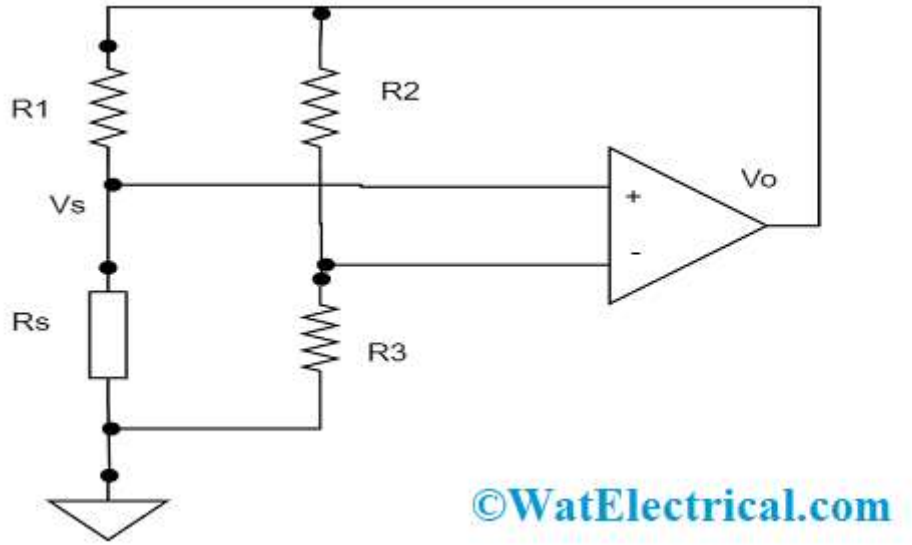
- The basic **principle of hot wire anemometer** is that when an electrically heated up is kept in the flowing gaseous stream, then the heat gets transferred from wire to gas and this reduces the wire temperature levels. Because of this, the wire's resistance value also gets changed. This variation in wire resistance allows us to calculate the flow rate of the liquid.



WORKING

The **working of hot wire anemometer** can be known using two types

- Constant current method
- Constant temperature method



WORKING

CONSTANT CURRENT METHOD

- In this method, the hot wire anemometer is kept in the **fluid flow** where here speed of the liquid flow can be calculated.
- From the wire, a constant **magnitude level of current is passed.** Also, the wheat stone bridge is maintained at a steady voltage level.
- When the wire is placed in the liquid flow, then heat transfer takes place to **liquid from the wire**.
- As because the **heat has a direct relation** to the wire's resistance, when heat value reduces, the wire's resistance also gets decreased.
- Also, the **wheat stone bridge** calculates the change in resistance value that is equivalent to the liquid's speed flow.

WORKING

CONSTANT TEMPERATURE METHOD

•In this method, the wire gets **heated up by the electric current,** the hot wire anemometer is kept in the fluid flow where here speed of the liquid flow can be calculated.

•When the wire is placed in the liquid flow, then heat transfer takes place to **liquid from the wire.**

•Here, **the change in wire's temperature** value also modifies the resistance value. It is operated on the principle that the temperature level of the wire persists to be constant.

•The whole current that is required to bring the wire into the **starting condition** is similar to the gas speed flow.

Hot Wire Anemometer Equation

- **$a(v\rho + b)^{1/2}$ Joules/sec**
- 'v'-heat flow velocity
- ρ' - fluid density.
- b' - constant
- In the equilibrium case, the heat generated equals heat loss, then
- **$I^2R = a(v\rho + b)^{1/2}$**
- **$V = [I^2R/(a^2-b)]/\rho$**

Here 'I' corresponds to current and 'R' corresponds to the resistance of the wire. Both the temperature and the resistance values of the device are maintained as constant to calculate the fluid flow rate through the calculation of I.

ADVANTAGES AND DISAVANTAGES

ADVANTAGES

•These devices can be operated simply because no additional sensor equipment is required.
•The device is small and also provides high range of sensitivity
•Can deliver enhanced fluid flow rates
•These devices are exactly applicable to measure the high range of frequencies.
•It has minimal air velocities.
•It includes data hold functionality

DISADVANTAGES

- **DISADVANTAGES:**
- It requires more power to operate
- These devices are highly sluggish and need more time in heating up the wire
- For the ascending and descending values, the deflection is not similar and it varies
- The reading of the instrument is based on the values of atmospheric temperature

THANK YOU...