SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF MECHANICAL ENGINEERING

SENSORS AND INSTRUMENTATION

Guess Today's Topic????

Velocity measurement

- Electro-magnetic velocimeters (EMV) are among the best instrumentation available for studying the structure of the bottom boundary layer where sediment transport takes place.
- The EMV's are robust, resistant to fouling, moderately intrusive, and reasonably inexpensive, but they also suffer from severe limitations including offset drift, limited frequency response and relatively large sampling volume.
- Within the last few years, acoustic instruments have become increasingly available for coastal conditions. These instruments are also reasonably robust, resistant to fouling, and increasingly affordable. In addition, acoustic instruments are less intrusive, have better frequency responses and smaller sampling volumes. Examples are, the Acoustic Doppler Current profiler (ADCP), Ultrasonic Velocity Profiler (UVP) and the Acoustic Doppler Velocitymeter (ADV).

Velocity measurement

Electro-Magnetic Velocitymeter (EMV)

These instruments are based on the principle that a conducting fluid will generate a voltage proportional to the flow velocity as it passes through the magnetic field created by the sensor.

Velocity measurement

Acoustic Doppler Velocitymeter (ADV)

Basically, the ADV measures the velocity of particles (sediments) at a point in the water column from the Doppler shift in frequency of the emitted and received acoustic signals (without calibration) in 2 or 3-directions, depending on the sensor arrangement. The system includes three modules: sensor, signal conditioning module and signal processing module. The measurement probe consists of four ultrasonic transducers: a transmit transducer located at the bottom end of the stem and three receive transducers, slanted about 30o from the axis of the transmit transducer and pointed at the sampling volume, which is located about 0.1 m below the probed tip. Hence, the flow velocity in the sampling volume is not disturbed by the presence of the probe. The acoustic frequency is of the order of 10 MHz. The accuracy is of the order of approx.1% of the reading.

Velocity measurement

Acoustic Doppler Current Profiler (ADCP, UVP)

ADCP instruments are being used as:

•bottom-mounted (big-size upward-looking for velocity profiles over the water column; or small-size downward-looking for near-bed velocity profiles),

•ship-mounted (big-size downward-looking).

The ADCP profiler measures the current profile in water using Acoustic Doppler technology. It is designed for stationary and non-stationary (ship's hull mounted) applications. It can be deployed on the bottom, on a mooring rig, on a buoy or on any other fixed structure. It is a complete instrument and includes all the parts required for a self-contained deployment with data stored to an internal data logger. Typical applications include coastal studies, online monitoring and scientific studies in rivers, lakes, estuaries and tidal channels.

Velocity measurement

Comparison of measured velocities

Results of various instrument comparisons are given in the manual:

- Electro-Magnetic Velocitymeter (EMV) and Laser Doppler Velocitymeter (LDV)
- Acoustic Doppler Velocitymeter (ASTM) and Electro-Magnetic Velocitymeter (EMV)
- Acoustic Doppler Velocitymeters (ADV)
- Ultra-sonic Velocity Profiler (UPV) and Particle Image Velocitymeter (PIV)

Velocity measurement

- Tachometers, tacho generators, and resolvers are commonly used in measurement systems for measuring rotational speed and position of rotating machinery. Here's a brief overview of each type of sensor:

Velocity measurement

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Velocity measurement

- tachometers: Tachometers are devices that measure the rotational speed of a shaft or disk. They typically use a contact or non-contact method to sense the speed and convert it into an electrical signal. Tachometers are commonly used in automotive and industrial applications to monitor the speed of engines, motors, and other rotating machinery.

Velocity measurement

What is the Use of a Tachometer?

A tachometer helps gauge how hard your vehicle's engine is working, regardless of whether that vehicle is an automatic or manual transmission (road vehicle) or marine gear (boat).

According to HomeSteady, "machinery typically has an optimal working speed; if it's running too fast, it might suffer damage. If it's running too slow, there might be a problem with the machine or its power source. For example, poor lubrication, mechanical friction, or too great of a load might be slowing it down. A tachometer accurately indicates [working] speed."

For example, in an automatic transmission vehicle, a tachometer can tell you if the transmission shift points are in range or if the transmission is slipping. In a manual transmission vehicle, you can use a tachometer to determine the optimal time to shift gears (but it is not required).

Meanwhile, in marine applications, a tachometer allows you to identify the best operating range for your engine while ensuring that you don't exceed your maximum engine speed. It also may secondarily inform decisions the vessel's owner makes surrounding performance and fuel consumption.

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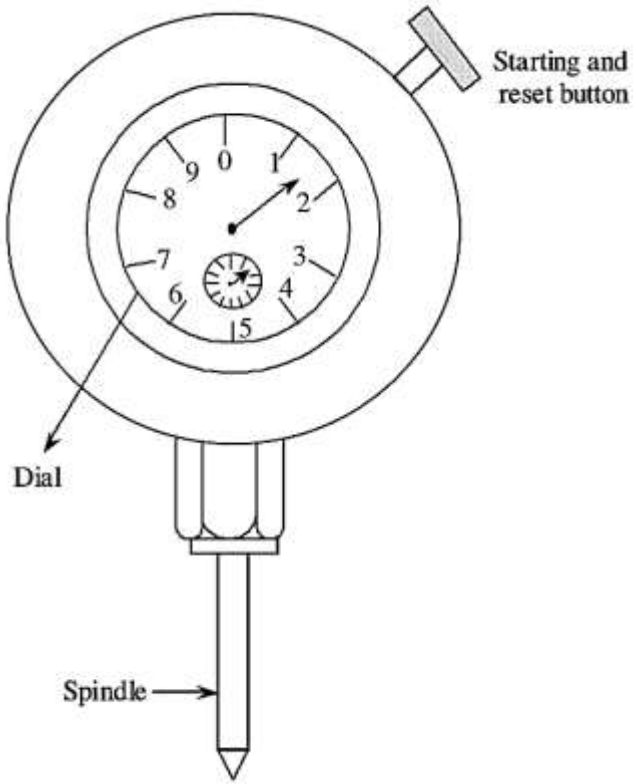
Velocity measurement

Types of Tachometers

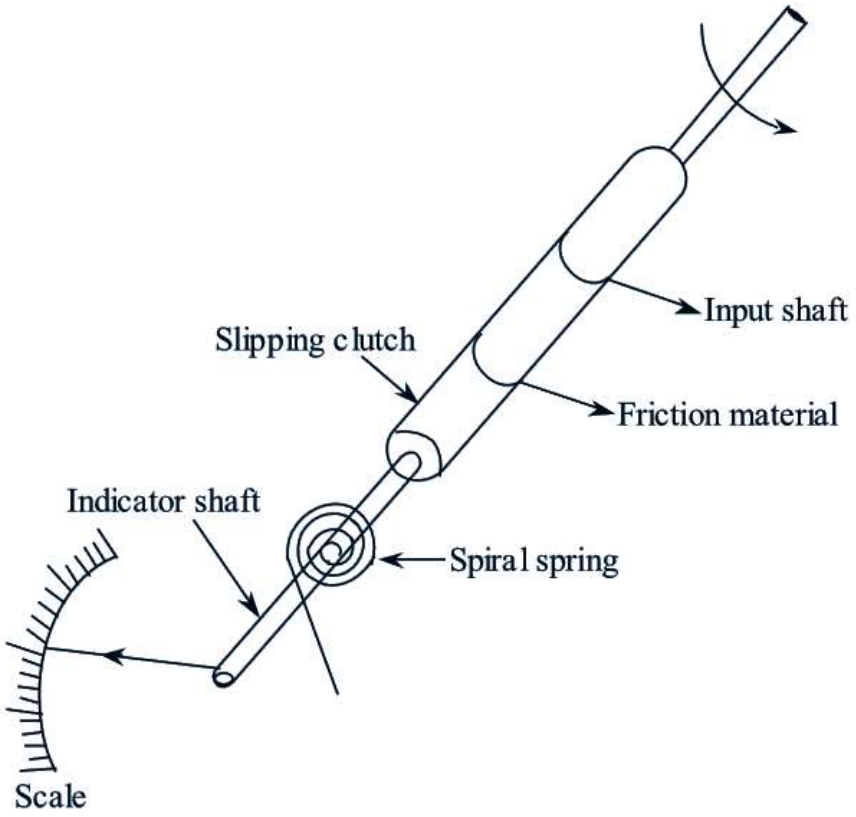
Tachometers may be mechanical (analog) or electronic (digital). According to Homesteady, “mechanical tachometers use electrical and magnetic forces to measure rotation speed; though they employ principles of electricity, they don’t need batteries. Electronic tachometers use electronic circuitry such as digital counters to determine RPMs. They use electric power, so they require batteries or other sources of current.”

In addition, tachometers may be contact or non-contact. A contact tachometer touches the rotating part you are measuring and is more precise. A non-contact tachometer uses light from a laser to illuminate a mark on the rotating equipment; this is typical in certain handheld models.

Velocity measurement



Velocity measurement



Thank you