SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF MECHANICAL ENGINEERING

SENSORS AND INSTRUMENTATION

Guess Today's Topic????

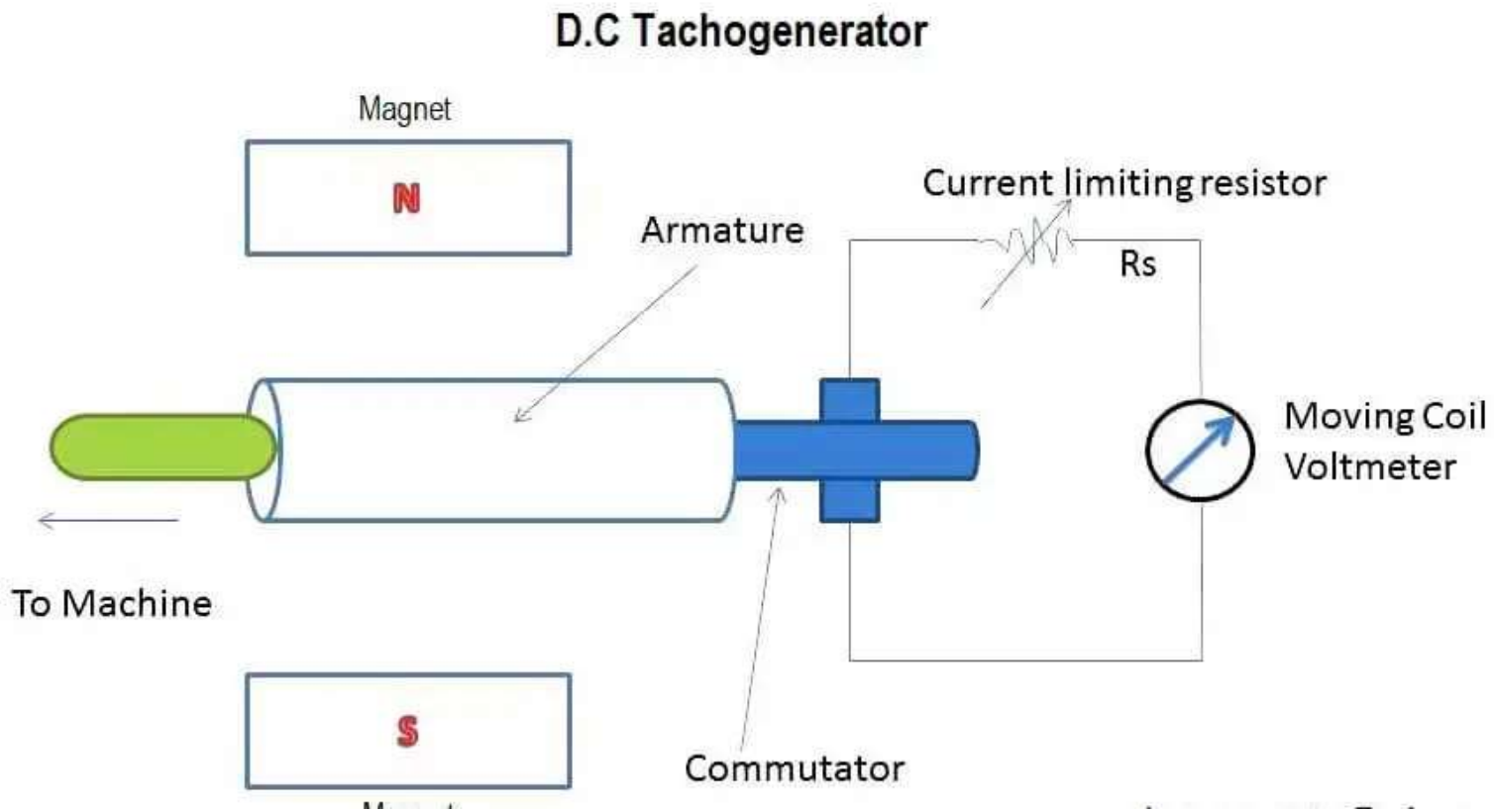
Tacho generator

The armature of the D.C Tachogenerator is kept in the permanent magnetic field. The armature of the tachogenerator is coupled to the machine whose speed is to be measured. When the shaft of the machine revolves, the armature of the tachogenerator revolves in the magnetic field producing e.m.f. which is proportional to the product of the flux and speed to be measured.

Tacho generator

Now as the field of the permanent field is fixed, the e.m.f generated is proportional to the speed directly. The e.m.f induced is measured using moving coil voltmeter with uniform scale calibrated in speed directly. The series resistance is used to limit the current under output short circuit condition. The polarity of output voltage indicates the direction of rotation. The commutator collects current from armature conductors and converts internally induced a.c e.m.f into d.c (unidirectional) e.m.f. while the brushes are used to collect current from commutator and make it available to external circuitry of the d.c tachogenerator.

Tacho generator



Tacho generator

Tacho generator advantages

1.The output voltage is small enough to measure it with conventional d.c voltmeters.
2.The polarity of output voltage directly indicates the direction of rotation.

Tacho generator disadvantages

The Disadvantages of d.c tachogenerator are as follows:

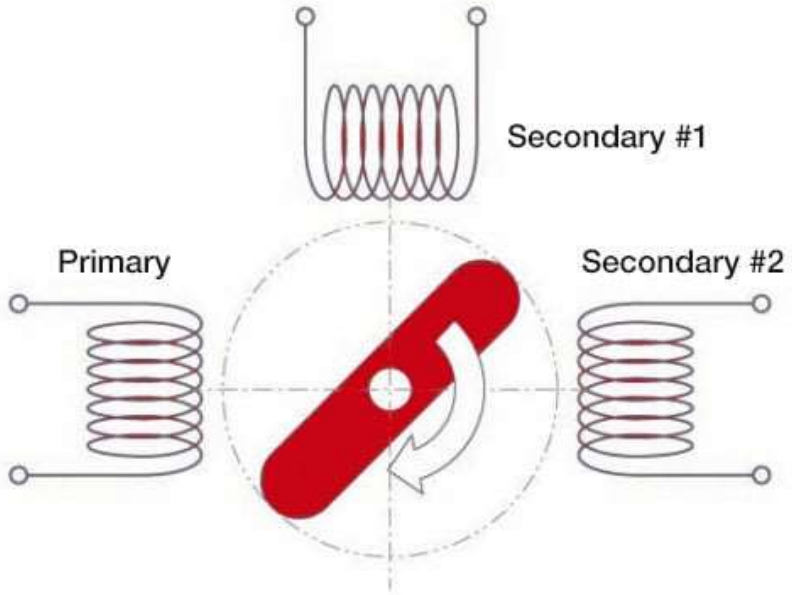
1.Because of variations in contact resistance, considerable error is introduced in the output voltage. Hence periodic maintenance of the commutator and brushes is required.

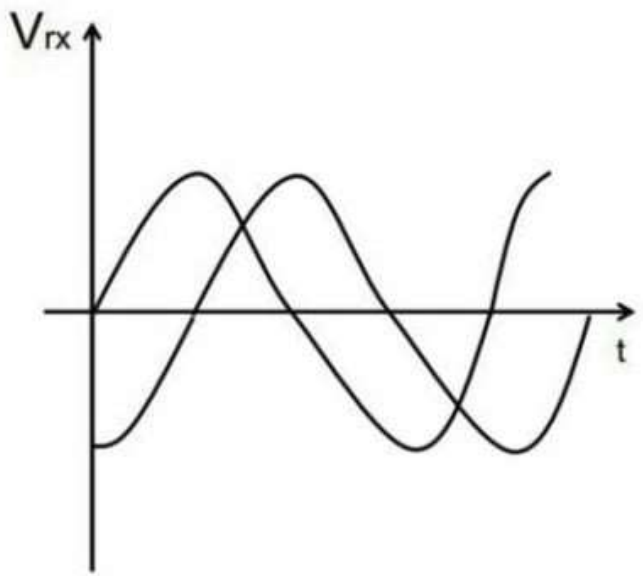
2.Non-linearity in the output of the d.c tachogenerator occurs because of distortions in the permanent magnetic field due to large armature currents. Hence input resistance of meter should be very high as compared to the output resistance of the generator.

Resolvers

Resolvers: Resolvers are rotary transformers that use an AC signal to provide a precise measurement of the angle and position of a shaft or disk. They consist of a rotor and a stator with multiple windings that produce a voltage proportional to the angle of rotation. Resolvers are commonly used in aerospace and military applications, as well as in industrial control systems that require high accuracy and reliability.

Resolvers





Resolvers

- When discussing RESOLVERS, people often interchange terms such as: encoders, rotary position sensors, motion feedback sensors, and transducer sensors. On occasion, synchros (cousin to the resolver) are also mentioned when explaining devices of this nature. Regardless of the names people choose to describe resolvers, their role in the world of automation remains unparalleled.
- Referenced as an analog sensor that is absolute over a single turn, the resolver was originally developed for military applications and has benefited from more than 50 years of continuous use and development. It was not long before numerous industrial segments recognized the benefits of this rotary position sensor, engineered to withstand the punishment of a military application. Product packaging plants and stamping press lines are perfect examples of where you might find resolver based systems at work. In typical applications, the resolver sensor feeds rotary position data to a decoder stationed in a Programmable Logic Controller (PLC) that interprets this information and executes commands based on the machines' position.

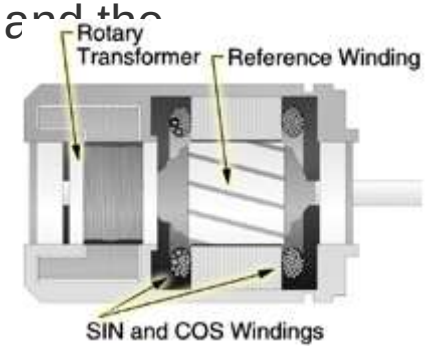
Resolvers

Recent advances in technology have enabled the integration of a **resolver** and on-board electronics in one housing as an alternative to other types of encoders. Referred to as DuraCoders, these motion sensing devices are available with the following output types; Absolute Parallel, Incremental Digital, Analog Current, Analog Voltage, and DeviceNet. The Absolute Parallel and Incremental Digital versions can also be ordered with a field programmable option. Using simple onboard switches, technicians and engineers can easily select the unique resolution required by the application, thereby reducing the number of units that must be stocked.

Through the evolution of machine development, builders and system integrators alike, agree that the '*resolver*' transducer is unsurpassed in its ability to reliably supply rotary position data in the harshest industrial environments.

Resolvers

A **resolver** is a rotary transformer where the magnitude of the energy through the resolver windings varies sinusoidally as the shaft rotates. A resolver control transmitter has one primary winding, the Reference Winding, and two secondary windings, the SIN and COS Windings. (See **figure 1.1**, Resolver Cross Section). The Reference Winding is located in the rotor of the resolver, the SIN and COS Windings in the stator. The SIN and COS Windings are mechanically displaced 90 degrees from each other. In a brushless resolver, energy is supplied to the Reference Winding (rotor) through a rotary transformer. This eliminates brushes and slip rings in the resolver and the reliability problems associated with them.



Typical Brushless Resolver Cross Section

Resolvers

In general, in a control transmitter, the Reference Winding is excited by an AC voltage called the Reference Voltage (Vr). The induced voltages in the SIN and COS Windings are equal to the value of the Reference Voltage multiplied by the SIN or COS of the angle of the input shaft from a fixed zero point. Thus, the *resolver* provides two voltages whose ratio represents the absolute position of the input shaft. (SIN θ / COS θ = TAN θ, where θ = shaft angle.) Because the ratio of the SIN and COS voltages is considered, any changes in the resolvers' characteristics, such as those caused by aging or a change in temperature, are ignored. An additional advantage of this SIN / COS ratio is that the shaft angle is absolute. Even if the shaft is rotated with power removed, the resolver will report its new position value when power is restored.

Thank you