Resolver

- A resolver is a detector of the absolute position or the absolute angle of the rotation.
- The encoder converts the amount of displacement into the digital format, while the resolver converts it into the analog format.
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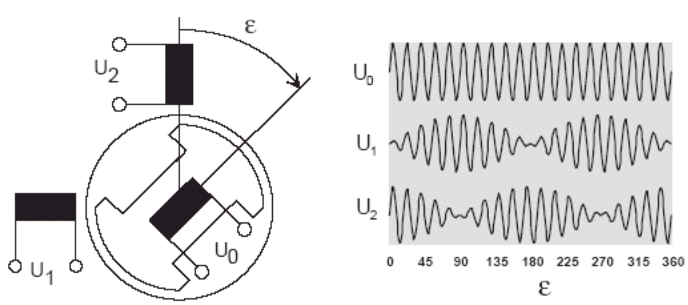
Resolver

- Figure shows the connection diagram and the associated signals of the resolver.



Resolver

- The sinusoidal excitation signal with a high frequency ranging between 2 kHz and 10 kHz is fed into the rotor winding (or primary winding, U_0).
- Other two stator windings (or secondary windings, U_1 and U_2) are mechanically placed orthogonal of each other on the stator side.

Resolver

- These windings produce two induced voltages that contain the rotor position information. Specifically, these resolver output signals are actually the sinusoidal excitation signals modulated with the amplitude of sine and cosine of shaft angle. The equations of these resolver output signals can be written as follows:

$$u_1(\varepsilon, t) = U_0.k.\sin(\varepsilon).\sin(\omega_{ref} t)$$

$$u_2(\varepsilon, t) = U_0.k.\cos(\varepsilon).\sin(\omega_{ref} t)$$

Resolver

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$$u_2(\varepsilon, t) = U_0.k.\cos(\varepsilon).\sin(\omega_{ref}\,t)$$

where - k is the transformation ratio of the resolver.

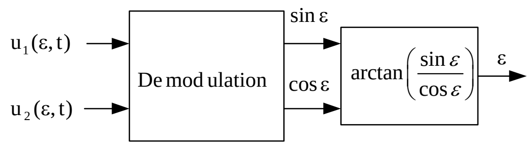
- U_0 and ω_{ref} is the peak value and the frequency of the excitation signal, respectively.
- ε is the rotor position

Resolver

- As a result, the resolver can sense the rotor position not only when the motor is rotating, but also when the motor is standstill.
- The process to calculate the absolute position and speed in the digital format from the analog resolver signals is known as Resolver-to-Digital (R/D) conversion.

Resolver

- The simplified block diagram of calculating the rotor position from the resolver signals is illustrated as follow:



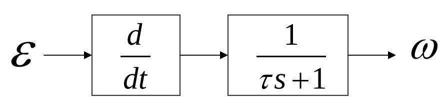
- Once the rotor position is available from the position sensor, then the speed could be simply calculated as follow:

$$\omega = \frac{d\varepsilon}{dt}$$

Resolver

- Normally, the low pass filter (LPF) is added to reduced the noise effect on the measured angle as follow:

(LPF)



where τ = filter time constant = $\frac{1}{2\pi f_c}$

f_c = cut-off frequency (Hz)