

Robotics and Assembly Lines
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Knowledge Test - Answers

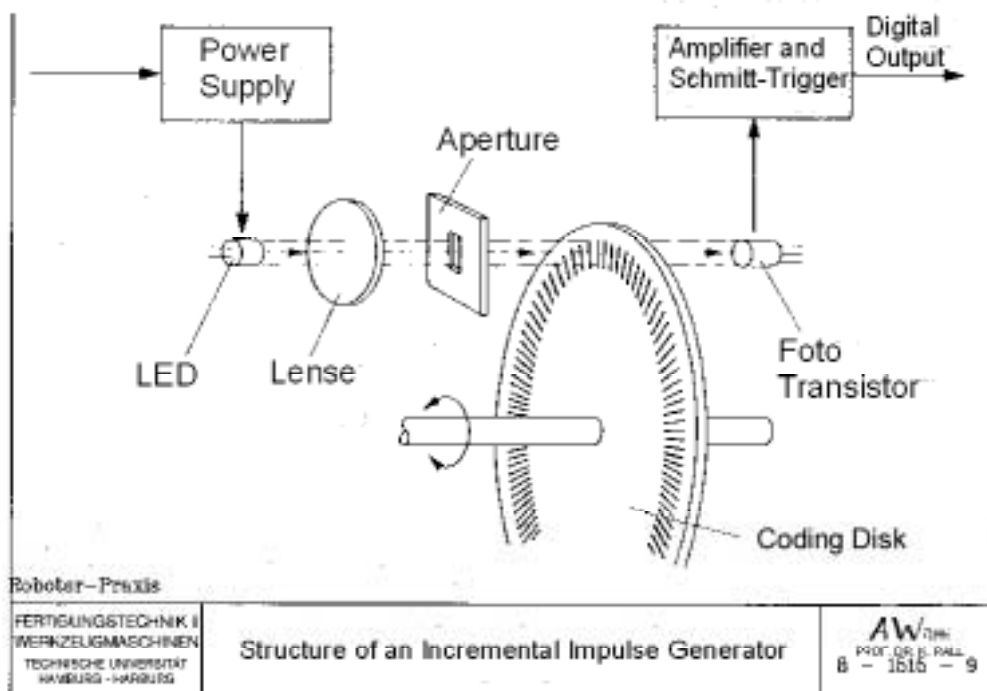
1. Sensors

a)

Direct measuring systems: fixed to the workpiece table or toolslide, movements between tool and workpiece are measured directly, high resolution of the measuring system is necessary, high accuracy of the measured values, expensive, difficult control with wear of transfer units, not economical.

Indirect measuring systems: fixed to the output of the motor, movements between tool and workpiece are measured with the transmission, small accuracy of the measuring system is needed due to gearing, measured values are inaccurate due to transmission errors, economical.

b)



2. Control

Point to point control:

for drilling or spot welding processes, the path of a movement from point A to point B is neither controllable or predictable.

Path control:

for complex turn and milling processes, the movements of the axes are in a strict functional dependency to each other while moving from point A to point B. Thus the trajectory is well-known.

3. Drives

Asynchronous motor: moderate dynamics, good control characteristics with modern electronics, wear-free, well overload-proof.

Direct current motors: good dynamics, good control characteristics by simple electronics, wear of the collector brushes, sensitive with overloading.

4. Mathematics

$$T(x) = \begin{pmatrix} \cos \varphi & -\sin \varphi \\ \sin \varphi & \cos \varphi \end{pmatrix} \cdot x + p \quad \text{mit} \quad \varphi = 30^\circ, \quad p = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

5. Vibration

$$\omega^2 = \frac{c}{m},$$

i.e. the bigger stiffness c and the lower the mass m of a vibratory system the higher is the natural frequency.