



Selected Chapters from Textile and Single-purpose Machines

Drive systems in the construction of single-purpose machines V.



Content

- Stepper motors
- Construction of stepper motors and their physical principle.



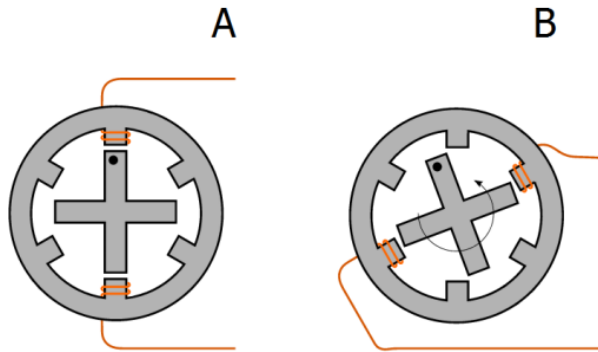
Stepper motors

- The stepper motor is a synchronous motor (the rotor rotates at the same speed as the rotating magnetic field in the stator).
- The rotating magnetic field is created by direct current, by gradually switching on the individual stator coils.
- The number of steps (stable rest positions) is determined by the number of pole pairs, it can also be influenced by the control method
- The motor stator consists of several pairs of coils (usually 4 pairs), which can be connected differently (both sides of the coil, two and two coils connected by one side of the winding, all coils with a common one side, in series, in parallel,...).
- The rotor is a cylinder of either magnetically soft or hard material with poles.



Stepper motors

The principle of a stepper motor



The stator has three pole pairs and the rotor four poles.

- **Location A**

The motor is in the first position, because the current flowing through the coils causes a magnetic flux that passes through the place with the lowest magnetic resistance - the rotor.

No current flows through the other coils!

- **Location B**

Switching the active coil creates a magnetic flux at another location. The rotor therefore rotates to give the lowest possible magnetic resistance, ie 60° to the left.

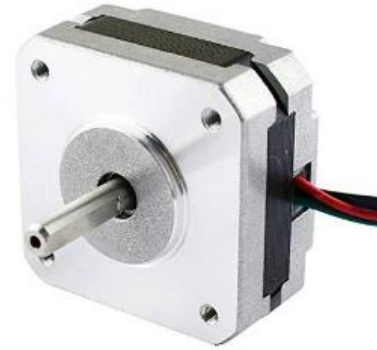
By rotating the individual pairs of coils quickly and gradually, the rotation of the rotor is ensured.

Stepper motors



- To avoid step loss, the KM drive must be ideally oversized. As the speed increases, the engine torque decreases sharply.
- The motor has the greatest torque at zero speed. It is advisable to use the feedback control the stepper motor then "approaches" the servomotor It is important to limit the resonant state of the drive. It can happen that even if the motor is not overloaded, a step can be lost at a certain frequency (speed).

Stepper motors



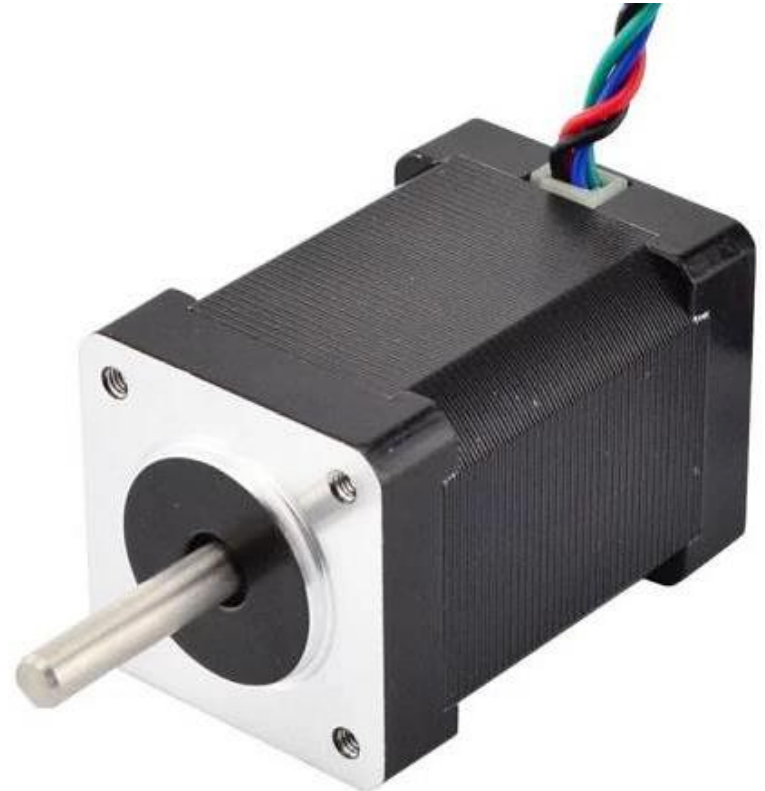
Advantages

- High positioning accuracy
- (according to step size)
- Simple control - open loop without the need for positional feedback
- Low acquisition costs
- High mechanical resistance
- Long service life (friction occurs only in rotor bearings)
- Almost maintenance-free operation - no brushes and commutator
- The stepper motor can be overloaded and stopped without damage
- Locking in the stopped state
- Large static moment Non-cumulative positioning error

Stepper motors

Disadvantages

- Relatively low moment load capacity
- The dynamic properties vary considerably with the magnitude of the moment of inertia of the load In case of overload - loss of step and instability of motor movement
- They are not suitable for extremely high rotational speeds



Review

- Describe the physical principle of a stepper motor
- List the benefits of a stepper motor
- List the disadvantages of a stepper motor



Thanks for your attention

