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PECULIARITIES OF OPERATING AC MOTORS WITH A COMMON SHAFT

In modern electromechanical systems, it is common for multiple electric motors to operate on a single standard shaft. This configuration is used in industrial installations, traction systems, pumping stations, and other mechanisms where power distribution among multiple drives is required. Despite its apparent advantages, the operation of AC motors with a standard shaft comes with several technical considerations that must be considered during the design and operation of such systems [1].

The main types of AC motors used in common-shaft configurations are induction and synchronous motors. Induction motors are the most widely used in industry due to their simple design, reliability, and low cost. However, load redistribution issues may arise when multiple motors of this kind operate in parallel due to parameter differences. Synchronous motors provide a rigid connection between the rotational speed and the power supply frequency, making their operation more predictable. Their use in multi-motor systems requires synchronization of all machines. In hybrid configurations, synchronous and induction motors operate together, balancing speed stability and flexibility in load regulation [1].

When multiple electric motors operate on a standard shaft, it is essential to consider the following aspects [2]:

1. Power distribution (The power should be evenly distributed among the motors; otherwise, one motor may be overloaded while another operates in idle mode).

2. Torque synchronization (Due to differences in motor parameters, parasitic torques may arise, affecting the system's overall efficiency).

Speed stabilization is significant for synchronous motors, as any deviation in one of the motors can cause mechanical stresses in the system. When using induction motors with different characteristics, there is a risk of circulating currents in the rotor circuits, leading to overheating and failure of one of the motors [2].

One of the main challenges in operating motors with a standard shaft is synchronizing their operation. The key issues and their solutions include [2]:

1. Different rotor inertia. (Mechanical overloads may occur during startup. This can be addressed by using soft starters or frequency converters).

2. Phase characteristic mismatches. (These can lead to vibrations and mechanical stresses. Implementing automatic synchronization systems helps minimize these effects).

3. Differences in motor characteristics. (If one motor has higher efficiency, it will take on a more significant load. This can be corrected by balancing the supply voltage or using identical motor models).

An additional optimization method is active drive control with digital regulation systems, such as industrial controllers or intelligent motor control systems. Proper synchronization of motors with a standard shaft offers several advantages:

- reduction of mechanical stresses on system components;
- increased equipment lifespan due to even load distribution;
- Improved energy efficiency is significant for industrial facilities with high power consumption.

Electric machines with a standard shaft are used in the following drive systems [2]:

- conveyor lines (multiple motors ensure uniform belt movement);

- traction drives (e.g., in electric locomotives, where the operation of multiple motors increases system reliability);
- pumping station systems (In such systems, distributing the load among multiple drives reduces the risk of overheating and failures).

AC motors with a standard shaft operate in a complex yet effective system that optimizes industrial and transportation operations. However, successful operation requires careful consideration of power balance, synchronization, and potential mechanical stresses. Modern drive control methods, including frequency converters and digital controllers, can solve most of the issues that arise, enhancing the efficiency and reliability of these systems.

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