New Simotics reluctance motors

Dynamic energy efficiency

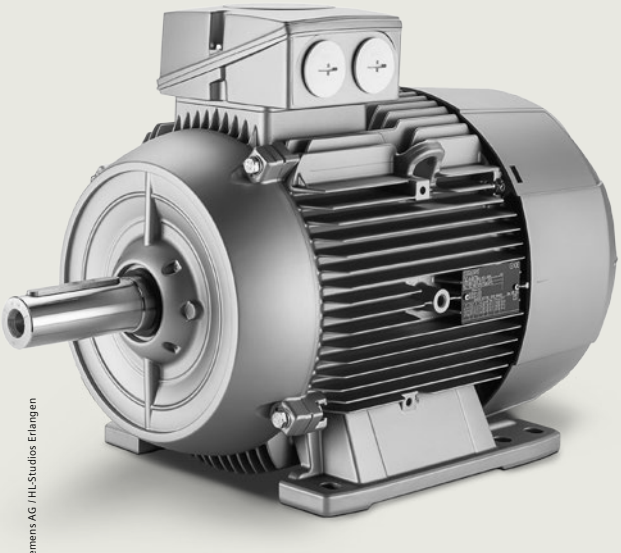
A new “old” drive principle adds momentum to the world of drives. The reluctance motor is experiencing a comeback as an energy-efficient and economical alternative to asynchronous and permanent-magnet synchronous motors. It is a motor in which efficiency and dynamics are no longer mutually exclusive. One convincing example is the new Simotics reluctance motor from Siemens.

The reluctance motor is not really new. It was first introduced in 1923 and then slowly sank into oblivion. There were many reasons for this, for example, the high cost of the special lamination. Since then, however, the problems have been solved and the synchronous reluctance motor is awakening from its deep slumber.

The secret is, among other things, that it needs no expensive or complex materials. The rotor of the reluctance motor has sheets made of iron that are magnetized during operation via the obligatory frequency converter.

The movement principle is similar to that of a permanent-magnet synchronous motor – only without the cost-intensive permanent magnets.

Comparable to the permanent-magnet synchronous motor in terms of performance and efficiency, the Simotics reluctance motor redeveloped by Siemens is far superior to the standard asynchronous motor when it comes to energy efficiency. Because it has the same dimensions as a standard asynchronous motor, it can be installed in many applications in place of an asynchronous motor without the need to change anything on the machine – making for a simple, low-effort switch to greater energy efficiency, because the new Simotics reluctance motor naturally surpasses the energy-efficiency values of a comparable IE4 Super Premium standard asynchronous motor. Due to the special design, the Simotics reluctance motor is particularly energy efficient in the partial load range.



Siemens AG / HL-Studios Erlangen

Simotics reluctance motor

Simotics reluctance motors are mechanically based on the 1LE1 energy-saving motors with a nominal speed of 1,500 min^{-1}. The first models are available for the range between 5.5 kW and 30 kW; the series will be expanded in the future to include the range between 0.55 kW and 200 kW. For the perfect design of the drives, Siemens supplies a number of support tools that save a great deal of time during planning, design, and commissioning.

Pa(i)r excellence

The matching Sinamics G120 inverter enables efficient and easy operation of the entire drive system, comprised of a Simotics reluctance motor and the Sinamics inverter. All the electrical data of the motor are already stored in the control unit of the inverter and are automatically entered into the inverter after the motor code is entered. The necessary manual entries are therefore limited to data such as cable resistance or inertia of the drive system.

Through the use of a Sinamics G120, the new reluctance motor achieves optimal functionality. The reluctance and asynchronous motors are in principle built the same way; however, although the reluctance motor generates higher motor currents than the asynchronous motor due to the somewhat lower power factor, if the motor is optimally controlled with a Sinamics G120 the energy efficiency is greater than in the asynchronous motor. In addition, the combination allows for simplified engineering and operating processes, due to the fact that the new Simotics reluctance motors can be overloaded by up to 20 percent of their nominal load even for longer periods. This offers significant advantages, especially in case of changing motion sequences.

Long service life and simple maintenance

Due to the current flow in the rotor, asynchronous motors become considerably warmer than reluctance motors. The new reluctance motor also has advantages when it comes to service and maintenance: replacing the rotor is just as easy as in asynchronous motors, because unlike in permanent-magnet synchronous motors, the rotor is not continuously magnetized. It is therefore very easy to separate the rotor and the stator.

Conclusion: With their special advantages, Simotics reluctance motors are perfectly suited for lifecycle-cost-optimized applications. In intermittent operation, the advantages of short run-up times due to the low moment of inertia are especially clear. Thanks to their high efficiency level in conjunction with an optimal control system, it is possible to realize additional energy savings. ■

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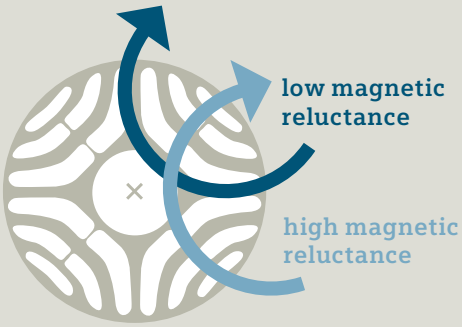
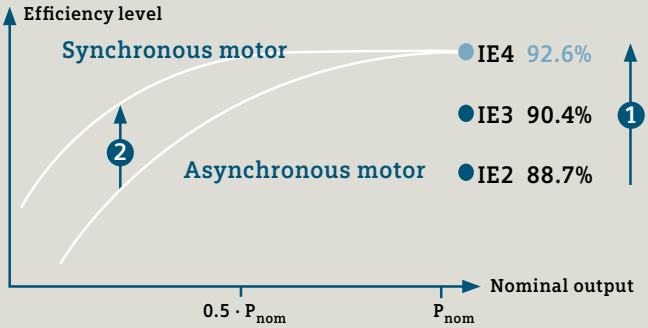
Operating principle of the reluctance motor



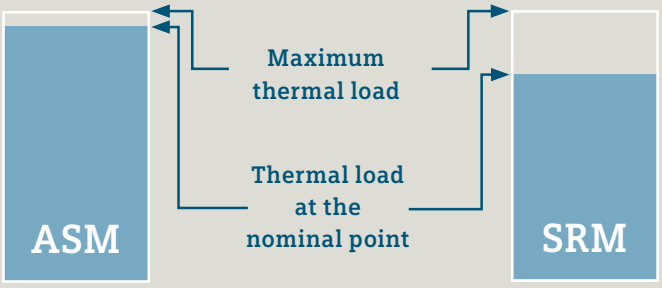
Reluctance motors operate according to the principle of magnetic reluctance, the magnetic equivalent to electrical resistance. The rotor consisting of air and iron has the least possible magnetic reluctance in one direction and the highest possible reluctance in the direction perpendicular to that. Because the system always moves toward the lowest magnetic reluctance, rotational movement results.

Technical advantages – energy efficiency



1 Realization of energy-efficiency classes higher than IE3 requires great effort for standard asynchronous motors.
2 Synchronous motors (permanent-magnet or reluctance) have a higher efficiency level in the partial load range than standard asynchronous motors.

Technical advantages – increase in performance



Large reserves with synchronous reluctance motors

- Permanent overload is possible, as the motors are not running at full thermal capacity at the nominal point.
- Technical background: compared to the asynchronous motor (ASM), the losses in the synchronous reluctance motor (SRM) are shifted to the stator, where they can be dissipated more easily. There are inherently almost no losses in the rotor.