Glossary

Electronic Linear-Actuator

Refer to Prototype of Electric Mechanical Actuator for Replacing Hydraulic Equipment (page 8)

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1 Actuators

The term "actuator" is defined by the Japanese Industrial Standard (JIS) [1] as "a device such as a motor or cylinder that converts hydraulic energy into mechanical energy ." This definition implies that the actuator is a type of energy converter. The JIS definition that only covers hydraulic equipment can be expanded to provide a wider scope of definition: "a device that converts energy, often hydraulic, electrical, or thermal, into kinetic energy such as rotation, linear motion or vibration, or vice versa."

Fig. 1 gives an overview of actuators with the form of energy on the horizontal axis and kinetic energy on the vertical axis. Arrows that appear along the horizontal or vertical axis indicate a direction of flow of energy. A conversion in the forward direction from the horizontal axis (form of energy) along the vertical axis (kinetic energy) is called a power operation (for electrical energy) or meter-in operation (for hydraulic energy), while a conversion in the reverse direction is called a regenerative operation (electrical) or a meter-out operation (hydraulic). More strictly, hydraulic cylinders and linear motors are energy converters that can support conversion in both the forward and reverse directions.

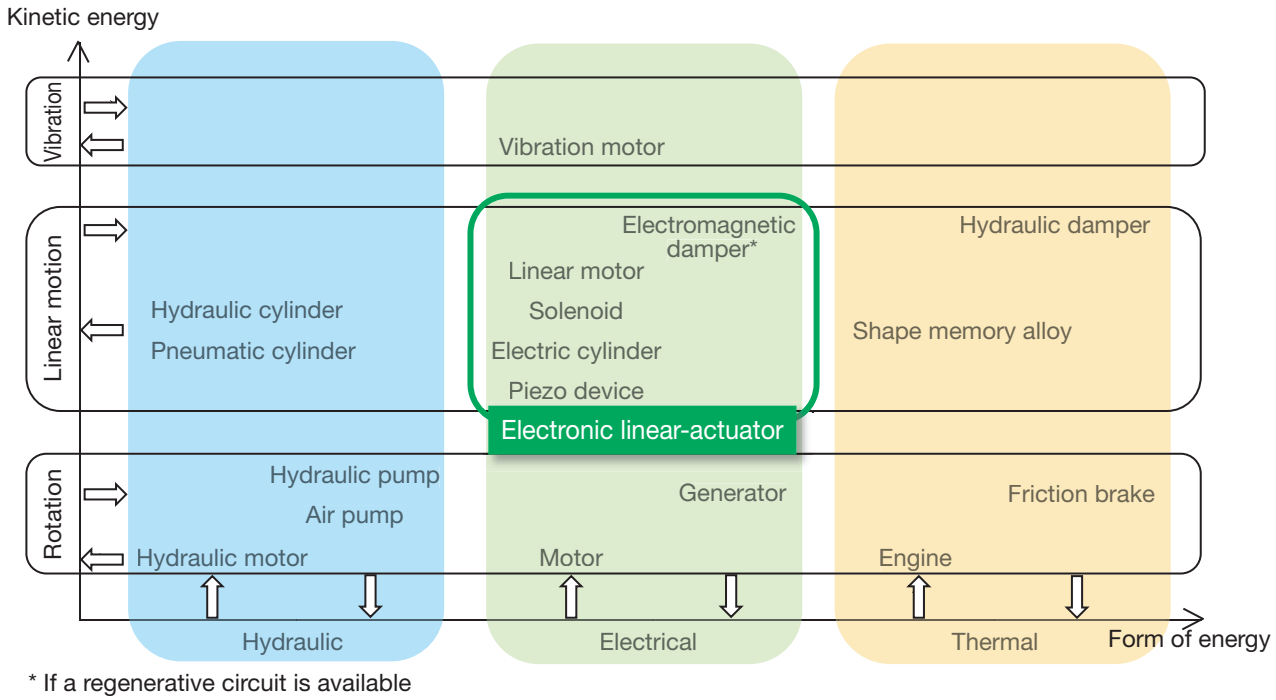

Fig. 1 Overview of actuators

2 Electronic Linear-Actuator

Electronic linear-actuators are those boxed in a green frame in Fig. 1. The electronic linear actuator is "a device that converts electrical energy into linear motion kinetic energy or a device that converts linear motion kinetic energy into electrical energy." Electronic linear-actuators are synonymous with electric mechanical actuators. The paper uses the term "electric mechanical actuator."

The electronic linear-actuator is available in two different configurations: "motor + ball screw" and "linear motor + sliding mechanism." Fig. 2 shows these configurations of electric linear-actuators from the viewpoint of energy conversion. The linear motor has the advantage of energy conversion takings place only once and potential energy efficiency being high, and has the disadvantage of having a magnetic section that would not contribute to the thrust at the moment of a stroke (Fig. 3). Note that the motor, which is a rotary machine, uses all the magnetic sections to deliver torque.

The relationship between the electronic linear-actuator and the linear motor is shown in Fig. 4. The linear motor is included in the electronic linear-actuator. Particularly in order for the electronic linear-actuator to replace the hydraulic cylinder or damper, the strut function corresponding to the sliding mechanism in Fig. 4 is important.

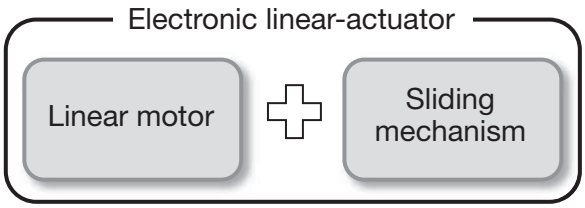

Fig. 4 Electronic linear-actuator and linear motor

3 Actuators in IoT

Recently, the Internet of Things (IoT), which connects a number of things and people over the Internet and creates new added value, has become popular worldwide. IoT consists of applications, clouds, security, networks, sensors, and actuators [2]. Among these, actuators play the role of the limbs of IoT. Electronic linear-actuators that are congenial to IoT are becoming more and more important.

References

1) JIS B 0142: 2011, Fluid Power Systems and Components - Vocabulary
2) KATAYAMA Akio, et.al, Textbook for IoT Engineers, Gijutsu-Hyohron

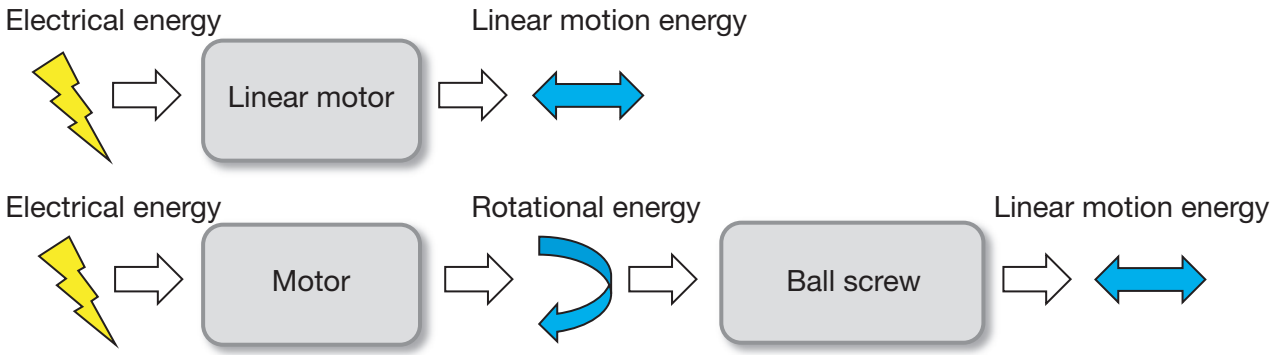

Fig. 2 Configurations of electronic linear-actuators

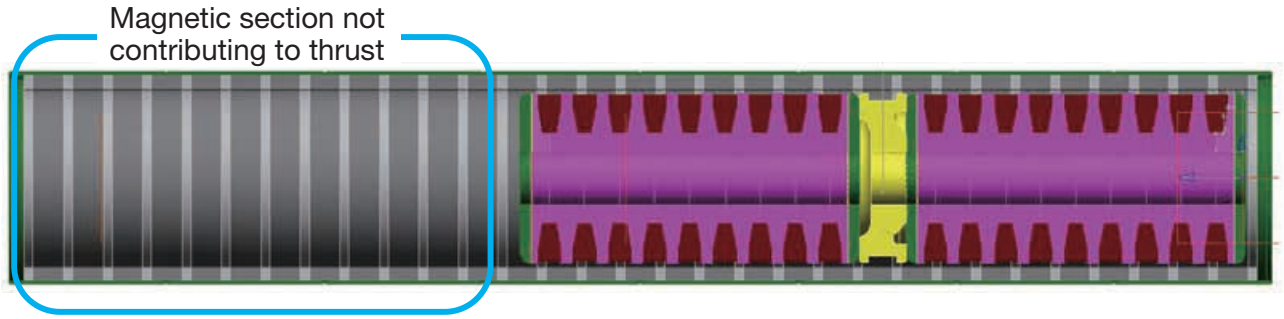

Fig. 3 Linear motor