[ABSTRACT of seminar on 7 Nov. 2014]

Applicability and Potentiality of Shape Memory Alloy Actuator

Donghyun Hwang

In diverse scientific and industrial fields, a demand for next-generation actuators is on the increase. The next-generation actuators might be defined as the actuators which have remarkable merits on the basis of their differentiated operating principle and working characteristics in comparison with conventional actuators such as electromagnetic actuator, hydraulic/pneumatic actuator, and so forth. Among several types of the next-generation actuators, as one of solid-state actuators, shape memory alloy (SMA) actuator has received much attention from several decades ago. The SMA actuator which works based on shape memory effect (SME: an effect that the material recovers its predetermined shape during solid-state phase transformation, from martensite phase to austenite phase, caused by temperature increase) exhibits attractive features: high energy density (high power-to-weight and force-to-volume ratio), large recoverable strain, mechanical simplicity and ease of operation, smooth and silent operation (muscle-like operation), workability in corrosive environment, high strength, wear, and fatigue resistance, biocompatibility, and so on. With these advantages, the SMA actuators have been utilized in various fields such as aerospace, robotics, biomedical engineering, automotive engineering, optical science, and so on.

This seminar will cover overview of the SMA actuator. Firstly, fundamental working principle, unique characteristics, and design trend including technical issues of the SMA actuator will be briefly explained with the historical background and origin. Several interesting examples of practical application in scientific and industrial fields will be presented. And then, as a recently developed SMA actuator, SMA cycloidal wobble motors devised with the aim of achieving bidirectional continuous rotation and high-torque capability will be introduced. On the basis of its development process including conceptual design, parametric analysis, and experimental characterization, the practical applicability and potentiality of the SMA actuator will be discussed.