Waving Tentacles: A System and Method for Controlling a SMA Actuator

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1 Introduction

When we see the wriggling movement and the shape of a tentacle like the sea anemone under the sea, we feel an existence of a primitive life. The goal of this research is to realize the expression of a kinetic artwork like waving tentacles of sea anemones by robotics. Previously, we have created two pieces of art, "Himawari" [Nakayasu 2010] and "plant" [Nakayasu and Tomimatsu 2010], using a shape-memory alloy (SMA) actuator driven in one direction. In this paper, we introduce a new SMA actuator that can bend in three directions. At present, soft actuators bending in multi directions is developed in several areas. For example, there is a medical active catheter, a microrobot mimicking annelid animals and animatronics. However, these have a complex structure or are expensive. To realize the expression of waving tentacles needs a large number of actuators (e.g. over one thousand actuators). Therefore, we developed a budget actuator with a simple structure.

2 SMA Actuator Structure and Motion Patterns

Fig. 1 is a drawing the SMA actuator structure. The SMA actuator driven by three Biometal Fibers (BMF150, developed by TOKI Corporation) can bend in three directions. The heat of each Biometal Fiber is controlled through a pulse-width modulation voltage. The SMA actuator behaves in three motion patterns, as seen in Fig. 2. The top of SMA actuator is illuminated by the optical fiber connected to the LED.

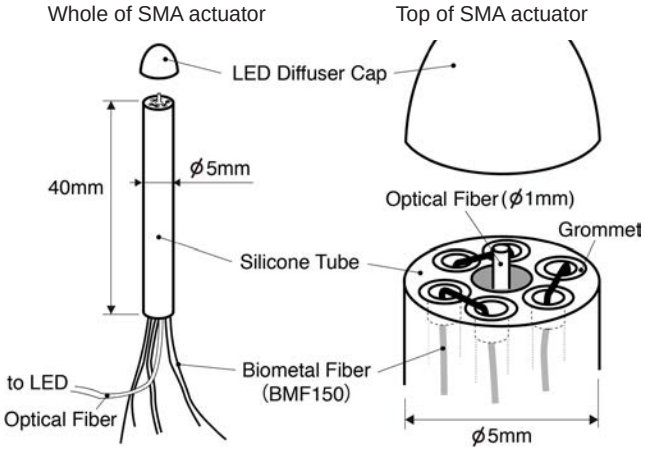

Figure 1. *Structure of a SMA actuator*

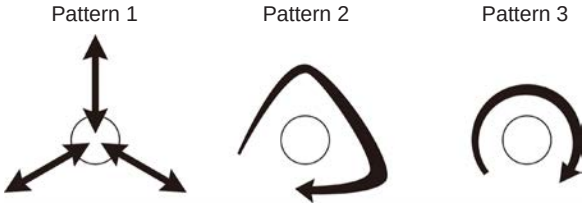

Figure 2. *Motion patterns (An upper view of a SMA actuator)*

3 9 Actuators Demo and Future Work

Fig. 3 is a snapshot of an experimental system with 9 actuators. We believe a larger number of actuators will allow the presentation of expressions that are easier to understand. In the future, we will develop a system with over one thousand actuators and interactive functions. Applications include interactive walls, digital signage using visual expressions, moving dolls in theme parks and a music visualizer.

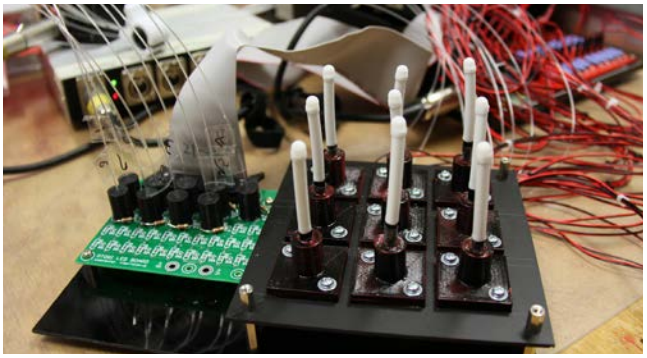

Figure 3. *An experimental system with 9 actuators*

Figure 4. *9 actuators in the darkness*

References

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