

## **Design of application-oriented photo responsive polymer devices based on optimization technique**

**Jaesung Park<sup>1</sup>, Hayoung Chung<sup>1</sup>, \*Maenghyo Cho<sup>1</sup>**

<sup>1</sup>School of Mechanical and Aerospace Engineering, Seoul National University, Republic of Korea

\*Corresponding author: mhcho@snu.ac.kr

Photo-responsive polymer (PRP) is the material including photo-reactive molecules in the polymer chain. When light is irradiated, well-aligned conformation of polymer chain is disordered hence whole PRP structure undergoes photo-induced deformation. Bending behavior is commonly observed in experiments when light is irradiated unsymmetrically on the PRP specimen, which makes PRP an attractive candidate to be used for long-range actuation. PRP shows a large scale, reversible elastic deformation, so geometric nonlinearity should be considered in analysis procedure. Therefore, we apply corotational formulation to include such nonlinearity. In this research, optimization analysis is performed to improve bending behavior based on specific applications of PRP devices such as gripper, drug delivery system, and photo-actuator. Topology optimization analysis is performed to obtain not only optimal geometric constituents, but also light irradiation pattern on PRP specimen to accomplish required mechanical behaviors.

**Keywords:** Photo-responsive polymer, Applications of PRP, Topology optimization, Nonlinear finite element method

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No. 2012R1A3A2048841).