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The Curvature of Bending Analysis and Motion of Soft Robotic Fingers by Full 3D Printing with MC-Cells Technique for Hand Rehabilitation

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Abstract : For many recent years, soft robotic fingers were used for supporting the patients who had survived the neurological diseases that resulted in muscular disorders and neural network damages, such as stroke and Parkinson's disease, and inflammatory symptoms such as De Quervain and trigger finger. Generally, the major hand function is significant to manipulate objects in activities of daily living (ADL). In this work, we proposed the model of soft actuator that manufactured by full 3D printing without the molding process and one material for use. Furthermore, we designed the model with a technique of multi cavitation cells (MC-Cells). Then, we demonstrated the curvature bending, fluidic pressure and force that generated to the model for assistive finger flexor and hand grasping. Also, the soft actuators were characterized in mathematics solving by the length of chord and arc length. In addition, we used an adaptive push-button switch machine to measure the force in our experiment. Consequently, we evaluated biomechanics efficiency by the range of motion (ROM) that affected to metacarpophalangeal joint (MCP), proximal interphalangeal joint (PIP) and distal interphalangeal joint (DIP). Finally, the model achieved to exhibit the corresponding fluidic pressure with force and ROM to assist the finger flexor and hand grasping.

Keywords : biomechanics efficiency, curvature bending, hand functional assistance, multi cavitation cells (MC-Cells), range of motion (ROM)
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