ABSTRACT

Persons with disabilities, specifically those who have lost their index fingers, face obstacles in performing daily activities. In Indonesia, individuals with disabilities affecting their hands have the highest unemployment rate. Prosthetics serve as an alternative solution, as they are devices used to assist when a part of the body is missing. Although various types of prosthetics are available, the majority focus primarily on aesthetics without considering functionality.

This study aims to design a functional prosthetic finger, based on the condition of other intact fingers. The prosthetic finger, made of epoxy resin/carbon fiber composite material, is created with the mirroring principle of the other intact fingers. The prosthetic finger is moved by a servo motor, based on the reading from the flex sensor, which is mapped to the servo motor movement angle to produce an accurate mirroring motion.

The sensor calibration results show an average value ranging from 831.15 to 934.5, with system and finger delay tests yielding maximum values of 248 μs and 301.37 ms, respectively. The angle test indicates a constant difference of 15° between the flex sensor and servo motor, with an average difference of 0.166° for PLA and 0.056° for the composite. Tensile tests show an average tensile strength of 28.675 MPa for PLA and 707.919 MPa for the composite, while density tests result in values of 1.3 g/cm³ for the composite and 0.9 g/cm³ for PLA. Functional tests reveal a gripping span of 20.6 cm, with the PLA finger lifting a bottle containing 120 ml of water and the composite finger lifting 180 ml. The epoxy resin/carbon fiber composite prosthetic finger proves to be more optimal for prosthetics requiring high functional and structural performance, supported by a precise control system using a flex sensor and servo motor.

Keywords: Prosthesis, Flex Sensor, Servo Motor, Mirroring, Mapping, Epoxy Resin/Carbon Fiber Composite.