

## Development of haptic based piezoresistive artificial fingertip: toward efficient tactile sensing systems for humanoids

### ABSTRACT

Haptic sensors are essential devices that facilitate human-like sensing systems such as implantable medical devices and humanoid robots. The availability of conducting thin films with haptic properties could lead to the development of tactile sensing systems that stretch reversibly, sense pressure (not just touch), and integrate with collapsible. In this study, a nanocomposite based hemispherical artificial fingertip fabricated to enhance the tactile sensing systems of humanoid robots. To validate the hypothesis, proposed method was used in the robot-like finger system to classify the ripe and unripe tomato by recording the metabolic growth of the tomato as a function of resistivity change during a controlled indentation force. Prior to fabrication, a finite element modeling (FEM) was investigated for tomato to obtain the stress distribution and failure point of tomato by applying different external loads. Then, the extracted computational analysis information was utilized to design and fabricate nanocomposite based artificial fingertip to examine the maturity analysis of tomato. The obtained results demonstrate that the fabricated conformable and scalable artificial fingertip shows different electrical property for ripe and unripe tomato. The artificial fingertip is compatible with the development of brain-like systems for artificial skin by obtaining periodic response during an applied load.

**Keyword:** Artificial finger; Haptic sensors; Nanocomposite; Modeling; Harvesting robot