

# DESIGN AND ANALYSIS OF MICRO-GRIPPER USING COMSOL FOR DRUG DELIVERY APPLICATIONS

Elango Murugappan and Adithyan Annamalai\*

Thiagarajar College of Engineering, Madurai, Tamil Nadu, India – 625015

\* Corresponding author

## ABSTRACT

A microgripper is one of the key instruments used in drug delivery applications. They can ably handle sub-micron objects within the diametrical range 15-25 $\mu$ m without any damage. A few objects that can be handled using microgrippers include medicinal tablets, capsules and micro particles. The major factors having an influence on the performance of micro-grippers include materials utilized, displacement amplification, contact pressure and gripping range. This work is aimed at improving the performance of existing micro grippers keeping in mind their key performance parameters. The existing micro gripper used in drug delivery applications is modelled using COMSOL package. It was then analyzed to find key parametric values. Also, three modified designs of the microgripper were designed keeping in mind the rigidity of the gripper. They were analyzed using COMSOL and the best design among the three was selected and compared with existing microgripper model. The modified microgripper model showed enhanced displacement amplification, contact pressure and gripping properties. The influence of materials utilized on the modified designed of the microgripper is studied. It was found that the microgripper made of Si<sub>3</sub>N<sub>4</sub> base material and Lead Zirconate Titanate (PZT) piezo material showed maximum deflection and maximum contact pressure. Also, a detailed analysis on von mises stresses, gap distance including offset is carried out on the modified micro gripper design using COMSOL package.

**Keywords:** Microgripper, drug delivery, displacement amplification, contact pressure and stress analysis.

