**INTRODUCTION:** Untethered small-scale robots inspired by microorganisms evolved have greatly attracted attention from scientists and engineers to non-invasively access and navigate in limited accessible environments to perform therapeutic and diagnostic operations.\(^1\)\(^-\)\(^3\) However, these soft robots actuated by distributed torques cannot be simulated in many commercial finite-element software.\(^4\)\(^,\)\(^5\)

**RESULTS:** For the robot with 3.7 mm in length, approximate discrepancies of 30% are observed between simulated swimming speed \((V_{\text{swim}})\) and that predicted by Taylor’s model under varied field strength, as illustrated in Fig 3(a). At the length of 1.85 mm, the simulated \(V_{\text{swim}}\) even reduces to approximately one-third of \(V_{\text{swim}}\) predicted by Taylor’s model, as shown in Fig 3(b). The prediction of the theoretical swimming gait function shows great consistency with simulated results, However, Taylor’s model is nearly invalid to describe the swimming gaits of the robot, as shown in Fig. 4.

**COMPUTATIONAL METHODS:** The robot is divided into several equivalent elements whereby the distributed magnetic body torques are replaced by a summing magnetic torque realized by two opposite and tangential surface forces (Unit: \(\text{N/m}^2\)) with respect to boundary frame, as shown in Fig. 2. Tangential surface force magnitude in a certain element \((F_i)\) is expressed as

\[
F_i = M^1_x B_y - M^1_y B_x
\]

**CONCLUSIONS:** The undulating swimming gaits of the robot in low-Re conditions is simulated and commendably characterized by the proposed theoretical model extensively different from Taylor’s model, which provides a general scheme for the study of soft-bodied locomotion.

**REFERENCES:**