

New method proposed for preoperative needle insertion trajectory planning

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Percutaneous needle insertion is a widely used technique in needle-based interventions. However, it is difficult to achieve high targeting accuracy due to needle deflection and the boundary effect in multilayered tissues.

Researchers from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences proposed a preoperative

[needle](#) insertion trajectory planning method that includes needle deflection modeling, insertion angle correction and needle trajectory optimization.

Their study was published in *IEEE/ASME Transactions on Mechatronics* on August 3.

This needle deflection model could predict the needle deflection with preoperatively obtained information, containing tissue-specific parameters and the geometric/material properties of the needle.

In order to correct insertion angles at tissue boundaries, the researchers took the influence of boundaries between layered tissues into consideration, and designed an insertion angle shift distribution model based on [experimental data](#).

In addition, the needle trajectory optimization was based on the weighted sum of cost function. It balanced the assessment criteria, including the trajectory length, the insertion angle, and the distance to critical structures, and determined the needle trajectory with the best performance.

Experimental results demonstrated that with the proposed preoperative needle insertion trajectory planning method, a needle insertion trajectory with desired insertion length and insertion angle and [safe distance](#) to critical structures could be obtained. The needle [insertion](#) accuracy increased from 4.30 mm to 0.97 mm in gelatin model and from 5.15 mm to 1.40 mm in animal tissue model.

More information: Baoliang Zhao et al. Needle Deflection Modeling and Preoperative Trajectory Planning during Insertion into Multilayered Tissues, *IEEE/ASME Transactions on Mechatronics* (2020). [DOI: 10.1109/TMECH.2020.3013708](#)

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