

## Pressure-Detecting Method for Estimating Levitation Gap Height of Swirl Gripper

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**Abstract :** The swirl gripper is an electrically activated noncontact handling device that uses swirling airflow to generate a lifting force. This force can be used to pick up a workpiece placed underneath the swirl gripper without any contact. It is applicable, for example, in the semiconductor wafer production line, where contact must be avoided during the handling and moving of a workpiece to minimize damage. When a workpiece levitates underneath a swirl gripper, the gap height between them is crucial for safe handling. Therefore, in this paper, we propose a method to estimate the levitation gap height by detecting pressure at two points. The method is based on theoretical model of the swirl gripper, and has been experimentally verified. Furthermore, the force between the gripper and the workpiece can also be estimated using the detected pressure. As a result, the nonlinear relationship between the force and gap height can be linearized by adjusting the rotating speed of the fan in the swirl gripper according to the estimated force and gap height. The linearized relationship is expected to enhance handling stability of the workpiece.

**Keywords :** swirl gripper, noncontact handling, levitation, gap height estimation

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