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# MULTIMODAL PERCEPTION BASED CALIBRATION METHODS AND DEVICE OF HUMANOID FINGER SENSOR

**Abstract**

In order to adapt to space operation tasks of high precision and flexibility, space robot needs to be equipped with finger sensors that can sense a variety of physical conditions and achieve different functions. Depending on a new humanoid finger sensor with multimodal perception capability, physical properties such as contact force, temperature, texture features, surface roughness, micro vibration, etc., could be easily extracted from different objects. In this paper, a unified multimodal perception calibration device platform has been created, as well as the related actuators, control system, hardware and software system. In view of the contact force and temperature characteristics with touched object, the Least Square Method is proposed for data fitting and parameter predicting, which is used to implement precise calibration for force point location and pressure distribution. According to different surface texture features, the Frequency Spectrum Analysis Method is presented by using Fast Fourier Transform to determine different physical properties of objects by the size of frequency and energy distribution. Through the analysis of calibration data and results, the contact force and temperature ranges with good linearity are obtained; meanwhile the method for how to distinguish objects with similar texture features is put forward by developing the frequency spectrum analysis rules. This study provides a set of systematic calibration methods for the humanoid space robot fingers, which can be served as a fast and efficient reference to perceive multimodal objects in creating state database.