INDUSTRIAL ROBOT CALIBRATION USING A VIRTUAL LINEAR CONSTRAINT

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Abstract- This paper proposes a systematic method to identify the joint zero offset of industrial robot. Small offset always exist in robot joint, which affect the precision in kinematic equations leading to calculate wrong joint angle values. To solve these problems, the proposed method employs a portable dual Position Sensitive Detector (PSD) device and a focusable laser point (FLP). The portable dual PSD device comprises two fixed PSDs tilted in an angle to reflect the laser line from one PSD to another. The FLP, attached to the robot end-effector, aims at both centers of the two PSDs at the same time, effectively creating a virtual linear constraint for the robot end-effector. As a result, small variations in position and orientation of the end-effector are magnified on the laser spot's location at the PSD's surface. Hence, the resolution of measuring the position and orientation of the end-effector is improved due to the high precision feedback of the PSD, increasing the accuracy of joint angle measurements that are required to calibrate the robot. From the easily measured joint angle readings, and an identification model, the joint zero offset of

industrial robot is calibrated. The effectiveness and accuracy of the method are verified using both simulations and real experiments on an IRB120 robot.

Index terms*:* Industrial robot, robot calibration, zero offset, portable dual PSD device, laser point.