Kinematic identification is the process of estimation of the parameters which define the geometry of industrial robots. This is necessary for accurately positioning the robot especially in unstructured environments. The main topic of discussion in this thesis is kinematic identification of an industrial robot using a camera which may be already mounted on the end-effector of the robot for another task.

Pose measurement and calibration of a camera using a single image is proposed. Its performance was better than that of the conventional calibration techniques which required multiple input images. Pose measurement using a single camera for the purpose of kinematic identification is discussed next. For this purpose, a geometric technique called Circle Point Analysis (CPA) was adapted such that both position and orientation data could be used. Using a new approach which allows use of previously un-calibrated camera, it was possible to estimate the kinematic parameters, and the performance was better than that obtained using a calibrated camera for restricted actuation of joints. However, calibrated camera permitted larger joint actuation and gave the best estimate thanks to the use of fiducial markers which helped to annul the restriction imposed by the field of view. Repeatability of the robot was also measured using the proposed pose measurement method and was close to the actual specifications of the robot. A method of combining the CPA style of conducting experiments and the parametric technique of estimation, utilizing an identification Jacobian calculated through backward recursion, was proposed next. After identification, the improvement of robot's accuracy was close to that obtained while using a laser tracker which is commonly utilized for kinematic identification. Hand-eye transformation was also obtained at the same time. In addition to this, calibration of a 2-D laser scanner mounted on the end-effector of a robot was also expounded. Kinematic identification resulted in improvement of the measurement accuracy of the 2-D scanner. The resulting setup of the camera with a 2-D laser scanner could be used for applications like bin-picking, 3-D point cloud generation, etc. Using the generalized calibration technique inspired by the methods presented earlier, a pro-
jective display was converted to an interactive display and could be used for teaching alphabets to children.