PROJECT TOPIC

DITTO – THE ADVANCED LEAD THROUGH ROBOT

ABSTRACT:

Recently robots are widely used in a various field particularly in the industry. Despite this fact robot still requires an undeniable amount of knowledge from the operators or workers who deal with them. As a result, robots cannot be easily programmed if the operator or the worker is not experienced in robotics field. One of the programming methods that has been introduced to make programming task user friendly is lead-through robot programming. However, the existing lead-through programming methods still requires an amount of knowledge that is not available for most of the operators and workers. The main objective of this project is to design a lead through method for point to point robot programming using incremental encoder feedback, which can record, save and playback the robot motion while considering the accuracy and precision of the robot. To validate the method, experiments were conducted in this project, where an operator manually moves a two DOF (degree of freedom) robotic arm on a white board while the encoder feedback was recorded and later played back by the robot. Then both recorded and playback trajectories were compared and analyzed.

Generally, Robots are programmed using "on-line" or "off-line" methods.

In an On-Line Programming, the Robot moves in sympathy with commands used by the teacher / programmer. A record play-back approach where the Robot plays back a sequence of moves. There are two types of on-line teaching,

1) Lead-Through

This method is used to teach Robots to carry out such tasks as paint spraying or Applying adhesive to an irregular surface. The Robot arms using this teaching method are typically ones with wrist motion plus three degrees of freedom and having revolute joints. The Robot is taken through its operating cycle manually and the movements of each axis are logged automatically at frequent intervals. The joint position sensors ( potentiometer or encoded discs ) provide position information as the Robot is moved through its cycle. The positional information is sampled periodically and stored in the computer memory. When played back the end effector appears to follow a continuous path. Moving the limbs of an undriven Robot can impair the free hand movements of the teacher, in order to overcome this problem the programming can be done using a skeleton arm or counter balanced arm just for the teaching process. This method has the advantage of simplicity but requires reprogramming for each new task eg. painting a different component.

Lead-Through programming

2) Drive-Through

This programming method is used for industrial tasks of a pick and place nature such as spot welding and machine loading and unloading. The Robot movements are controlled by inputs from a teach pendant or keypad, the programmer can specify the movement and velocity of each robot limb between two points. The Robot cycle is a sequence of such movements which can be observed during the programming. In the play-back period the programmer can modify the sequence to get optimum cycle time and accuracy. The majority of Robots on the marlcet use drive through programming. The programmer need not be skilled in the Robot task as in the case of lead through. When programming the operator may need to be very close to the driven robot, this can create potential safety problems.

Drive-Through programming

A typical Teach Pendant

Off-Line Programming

Off-line programming of Robots is used to control the overall sequence of tasks carried out in a Robot serviced system. The drive through programming method will still be used but only at discrete points in the overall sequence where positional accuracy is required. In off line programming the program uses a high level computer language such as VAL which gives the Robot decision making power. This method needs a large amount of computing power and incorporates the use of sensors on the Robot or within its environment to provide system status information. Typical input sensos could be of the position, vision and tactile types. Information from the sensors can allow the Robot to take alternative action within its overall task cycle. eg A Robot being fed by a number of machines will only stack finished components from a machine where a component is available. Using off line programming the Robot can make decisions such as counting a number of operations or perform one task until another is ready to be started. Robots which are off-line programmable are more useful in a production situation since they can be reprogrammed with a minimum of interference to the production process.

(a) Off-line programming

(b) Coordinate entry programming