

TRAJECTORY TRACKING CONTROL BASED ON A GENEALOGICAL DECISION TREE CONTROLLER FOR ROBOT MANIPULATORS

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ABSTRACT. *The performance of a simple and easy-to-implement control design technique in the control of robotic manipulators is examined. The suggested control approach is based on open-loop optimization using a genealogical decision tree (GDT), and can be used in solving both tracking control and regulation problems. The idea behind GDT consists of associating Gaussian distributions to both the norms of the control actions and the tracking errors. This stochastic search model can be interpreted as a simple genetic particle evolution model with a natural birth and death interpretation. A numerical example dealing with the control of a rigid two-link robot manipulator illustrates the feasibility and the performance of this control algorithm.*

Keywords: Particle filtering, Population-based algorithms, Two-link manipulator, Open-loop control, Trajectory control, Random search, Optimization

1. Introduction. In order to increase productivity and quality, robots are used in many areas, such as manufacturing, military, space and ocean exploration, transportation, and medical applications. They can perform a wide variety of tasks: jobs that are repetitious and boring, difficult, or too dangerous for humans to perform. The control of robots is a central issue in the robot research area and has received a great deal of attention in the past few decades [7,9]. Non-linearity plays a strong role in the control of mechanical systems such as robots. For example, a robot arm is often used in industry and manufacturing. It mimics many of the movements of the human arm, having not only side-to-side and up-and-down motion, but also a full 360-degree circular motion at the wrist that a human can not perform.

Let us observe that:

1. Genetic algorithms, evolutionary strategies, genetic programming and evolutionary programming approaches have been widely used for robot training [9]. All these approaches are based on the concepts of genetics and evolutionary selection;