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Rethinking Robotic Arms for Research: A Reliable, High Precision, Low Cost Design

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Abstract
This paper investigates the use of new methods for the design of robot arms to improve their accuracy and strength without the use of expensive components or exotic gear systems. The result is a system with increased reliability compared to existing ones in this price category. The compromise we made is the use of a trapezoidal screw, similar to those used in CNC machines, that significantly reduces the speed but increases the overall accuracy and strength of the entire arm. Thus a millimeter precision can be achieved or even submillimeter depending on the type of screw used increasing the payload as necessary. The mechanical advantage is considerable and is not subject to the backlash phenomenon, so the control
scheme can be kept open using stepper motors and eliminating the need to use expensive position sensors and closed loop control schemes that requires intensive processing power. In this paper we present the relation between the parameters and the screw speed, accuracy and strength screw and a series of case studies that highlight the benefits of using this particular type of actuator arm screw. The prototype developed under this work has three degrees of freedom and can be used for very precise pick and place operations.

Keywords: robot, robotic, cost, design, reliability, precision

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