A Novel and Simple Power Saving Controller for Stepper Motors

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Stepper motors are used in printers, copiers, and industrial machinery because of their low cost, durability, and high positioning and holding performance. However, they have high power consumption. In order to address this problem, a novel control approach, referred to as the RE-system, is proposed. The proposed system incorporates photo-interrupters as rotor position detectors and phase comparators. A blinking light, regulated with a standard step-command pulse, is passed through the rotating slits of a rotor. The excitation light signal received through the slits then drives coils in the motor. Phase comparison is performed by interrupting the blinking light by the rotating slit. The present study compares the proposed RE-system with standard methods, which, in general, operate using the maximum power consumption level, regardless of the system state. By controlling the excitation time by responding to changes in load, the power consumption of the RE-system in the rotating state is reduced by 31%. Moreover, by turning off the excitation in the stopped state without an external force, the RE-system reduces the power consumption by 78%. Whereas closed-loop control using microprocessors is complex and expensive, the RE-system is simply configured by adding photo-interrupters for both position detectors and phase comparators to the standard system. The RE-system is a simple and inexpensive method for reducing power consumption using open-loop control. In reality, low-cost control systems have been required in stepper motors, are employed in products which required durability and low-cost. The adoption of the RE-system will contribute to the prevention of global warming.

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