

不同加减速控制算法的能耗分析与比较Research on Acc/Dec Algorithms Based on Energy Optimization

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关键词: 能量最优 加减速算法 运动控制 速度轮廓

摘要: 首先推导了理想加减速控制算法的最小能耗和梯形、二次样条曲线、S曲线、AS曲线加减速算法的速度函数, 然后根据速度函数与电动机耗能之间的关系求出了各加减速控制算法的耗能函数, 并通过Matlab编程求最小值, 发现当梯形曲线的加速时间和二次样条曲线的加加速时间分别设为 $T/3$ 和 $T/6$ ; S曲线的加加速时间和匀加速时间分别设为 $0.01T$ 和 $0.31T$ ; AS曲线的加加速时间和匀加速时间分别设为 $0.01T$ 和 $0.34T$ , 减速段时间调节系数 $R_2$ 设为 $0.98$ 时, 能够分别获得加减速算法基于能量最优的速度轮廓。最后通过计算不同加减速算法在不同时间设置情况下的耗能, 与最优速度轮廓的耗能比较, 得出同一算法在不同时间参数设置时能耗差别明显, 此外不同算法之间的能耗水平也有明显差别。The minimal energy dissipation of ideal velocity profile and the velocity function of general acc/dec algorithms were deduced. Subsequently, according to the relation between the velocity curve and the power dissipation in the motor, the energy dissipation function per step under the S curve velocity was derived, and its minimum was solved with Matlab. It is a new discovery that the optimal velocity can be gained when  $t_1$  of trapezoidal algorithm and quadric spline curve is  $T/3$  and  $T/6$  respectively;  $t_1$  and  $t_2$  of S curve algorithm is  $0.01T$  and  $0.32T$  respectively;  $t_1$  and  $t_2$  of AS curve algorithm is  $0.01T$  and  $0.35T$  respectively, and  $R_2$  is  $0.98$ . At last, the energy dissipation of acc/dec algorithms were calculated under the conditions of different time parameter settings, and were compared with the ideal velocity, more, there were obvious differences in energy dissipations of different algorithms. It is very useful to set the time parameters of acc/dec algorithms and improve the efficient of motor in acc/dec motion control.

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