

BASED ON INTELLIGENT CONTROL APPROACH TO PROLONG THE LIFESPAN OF ELECTRICAL CONTACTS

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ABSTRACT. *The objective of the paper focuses on developing a new fuzzy-hysteresis controller for an electromagnetic contactor to reduce the bounce duration after contacts closing. The experience-based fuzzy algorithm was combined with a hysteresis controller including simple characteristic. Certain important issues in electromagnetic contactor such as contacts bouncing and arcing problems have been resolved because the kinetic energy imposed on the armature prior to contacts impact was timely reduced. The lifespan of contacts is prolonged and the operating reliability of the electromagnetic contactor is then improved as well. The feasibility of the proposed scheme was validated through laboratory scale implementation.*

Keywords: Fuzzy-Hysteresis controller, Bounce duration, Electromagnetic contactor, Lifespan, Reliability, Arc

1. **Introduction.** Currently, contactors have been widely used in numerous automatic control systems and power distribution systems for the execution of their breaking and/or making processes. As we known, the breaking and making processes of contactors are completed by closing and opening their contacts. During the closing process, in fact, different bounce durations will be often produced between the movable contacts and the fixed contacts. Unfortunately, for certain loads, such as induction motor, their larger starting or inrush current flows through these bouncing contacts after contacts closing, arcs with high temperature must be then produced between two contacts. Destructive erosion for these contacts are produced and resulted in their using life of these contacts is reduced [1-3]. Especially, the bouncing phenomenon after contacts closing may result in the unpredicted malfunction of equipment.

In regard to bouncing problems of the contacts for the electromagnetic contactor, they have ever been concerned by many investigators. By using simulation or experimental approaches, many control strategies concentrated on the reduction of contact bounce are presented. For example, Nouri *et al.* [4] showed that the reason why the contact bounces were produced. Their conclusion is come from excessive kinetic energy forced on the armature prior to two contacts impact. Shortly, they used the power electronic technology and referred to the change of the armature displacement. The kinetic energy forced on the armature before contacts impact was controlled through timing coil energizing periods. In addition, other similar works were done as well [5,6]. For an ac electromagnetic contactor, Li *et al.* [7] found that the moving velocity of armature is profoundly affected by different closing phase angles of ac voltage source during the closing process. Hence, there was an optimization method for the determination of the optimizing closing phase angle of ac voltage source which was presented by them [8]. They took moving velocities lower than