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AN APPROACH TO THE REDUCTION OF CONTACT BOUNCE FOR AC CONTACTOR

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Abstract. *A new method based on selecting an optimal closing phase angle of ac sinusoidal excitation for the reduction of closing bounce duration of an ac electromagnetic contactor is presented. The proposed approach overcomes the uncontrollable contact bouncing problems imposed by previously described works and deals with systematical method. The attractive features of the proposed method are the reduction of bounce duration while the closing phase angle is optimized and several others important characteristics related to contactor are obtained through theoretical analysis and experimental validations. Computer simulations and prototype experiments, of the proposed method, demonstrate the numerous benefits that are offered by choosing an optimal closing phase angle on purpose.*
Keywords: Electromagnetic contactor, Contact bounce, Kinetic energy, Closing phase angle, Simulation, Experiment

1. **Introduction.** Contactors are electromechanical devices, which have been extensively used and played an important role in many electric power distribution systems and control systems. However, there is an undesirable problem, such that after the moveable contact first touches the fixed contact, and they could be repeated several times before they reach a permanent state, which has been bothering many engineers. In case of the contact closing bouncing phenomenon is combined with on-line starting current, such as induction motor, the starting current can be up to ten times of the nominal value, arcs with high temperature are produced between two contacts should result in the erosion of the contact material and electromagnetic interference (EMI) problem. Finally, the operation of the system where the contactor is included may lead to an undesirable result.

Numerous studies concerned with the contact bounce after contacts closing have been researched by many authors [1-5]. Lots of methods are proposed to improve the performance of switching device during closing process have been suggested, in particular, to minimize the kinetic energy before contacts closing or maximize the rate of dissipation after contacts closing. These objectives have usually been achieved by timing coil energizing periods according to armature displacement [6-12], or by using other intelligent control approaches [13-18]. Some relevant studies related to purposely select an optimal closing phase angle of the applied ac voltage source have ever been conducted by experimental methods [19,20]. However, little attention has been paid to the control of contact bounce during closing process from the theoretical view point. Regarding to research the energy relationship in each contactor subsystem and find an optimal closing phase angle of ac voltage source for the reduction of contact bounce after contacts closing exactly has not been explored before.