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STABILITY ANALYSIS OF A "THYRISTOR VOLTAGE CONTROLLER – INDUCTION MACHINE" MODEL

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Soft starters based on thyristorised voltage controller (TVC) are used as induction motor controllers in many industrial applications. At present soft start devices are developed based on the pulse-phase control system (PPCS) with TVC. A complicated mathematical modeling and simulation is a disadvantage of the PPCS-TVC of induction machines (hereafter PPCS-TVC-IM). It's difficult to research the PPCS-TVC-IM behaviors in transient and stationary states. For example, stability of the stationary states has been researched with the help of linearized models of the PPCS-TVC-IM especially. The PPCS-TVC can operate under two types of synchronization: line voltage synchronization and phase current synchronization. Oscillation processes, characterized by deviation of angular velocity of IM exist in the stationary states of the PPCS-TVC-IM with voltage synchronization. An averaging modeling approach does not allow to investigate this problem and to analyze the model stability adequately. Therefore, both an analysis of the dynamic behaviors and control algorithm design must perform by non-linear model. In the paper, such complete (non-linear) model of the PPCS-TVC-IM is used for simulation and stability analysis. The parametric stability analysis of the stationary state, base on monodromy matrix numerical calculation is carried out for both types of the model synchronization. In conclusion, the periodical processes of the stationary state are stable in both the turndown of the control angle and range of the IM inertia moment $J=J_{rated}..J_{rated}/8$. As shown in paper, current synchronization of the PPCS-TVC-IM decreases the oscillations in the stationary state. It makes current synchronization of the PPCS-TVC-IM more attractive for implementation against the voltage synchronization. Especially, it can use in both the soft start devices and energy-saving drive systems.

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