Title:	Energy Model Based Loss-Minimized Speed Control of Induction Motor with a Full Order Observer
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Abstract:
In this paper, a loss-minimization algorithm is developed to achieve maximum efficiency in terms of slip frequency. The optimal value of slip frequency can be obtained by minimizing all controllable losses of the induction motor (IM). The ratio of magnetic energy converted to torque (WT) to magnetic energy stored in the rotating field (Wq) is defined in terms of slip frequency to obtain an error function that is used to design a controller to achieve the desired speed. Since the energy model of the IM can be expressed by the multi-input and multioutput (MIMO) system, an MIMO optimal regulator is proposed to achieve the desired speed with maximum efficiency. To design an optimal regulator, it is necessary to measure all state quantities. But WT and Wq cannot be measured directly. Therefore, a full-order observer is proposed to estimate these state quantities. The gains of the observer system are calculated by using the pole placement technique. Consequently, the observer system becomes stable. The performance of the proposed controller and observer system are verified by using simulation. With regard to the simulation results, it can be concluded that the desired speed can be achieved by using the proposed controller and the unknown state quantities can be estimated properly by using the proposed observer system.

Keywords: Loss-minimization algorithm, Optimal regulator, Full-order observer, Induction motor, Speed controller