Fast speed prediction for better electric motors

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Video Abstract

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Abstract

Researchers from Japan and Massachusetts have devised a new way to estimate induction motor speed. Typically difficult to achieve for an object constantly in motion, that ability could lead to the construction of more efficient electric motors. Numerous industries literally run on induction motors. These electromagnetic engines are found in everything from small toys and appliances to giant construction equipment. One big improvement made to induction motor design in recent decades was the removal of the encoder—a fragile sensor that keeps tabs on the position and speed of the shaft during operation. Despite boosting engine efficiency and reducing size, this sensorless design can put performance at risk when trying to ensure smooth operation. And although indirect estimation methods have been developed, many are found to be lacking. Some, for example, assume rotor speed to be a constant parameter—which is hardly the case in practice. In their model, the research team treated rotor speed as a state variable rather than as a constant. Mathematically, that designation helps predict future states of the overall system based on a few, observable parameters. By changing the coordinates of their model's state variables, the researchers could design the filter to predict motor speed reliably. And by allowing the variables to fluctuate in unison, they could carry out experiments to predict certain variations in speed. Those experiments demonstrated that the proposed algorithm offers quick estimates on the fly and can be easily tuned. Further work is needed to address some issues raised by the study. For example, knowing all system parameters can yield better speed estimates. But that level of knowledge is hard, if not impossible, to come by in real-world systems. Currently, the team is planning experiments to improve the stability of their approach and its ability to be generalized to other systems.