# Predictive Stator Resistance Tuning for Induction Motor Drive

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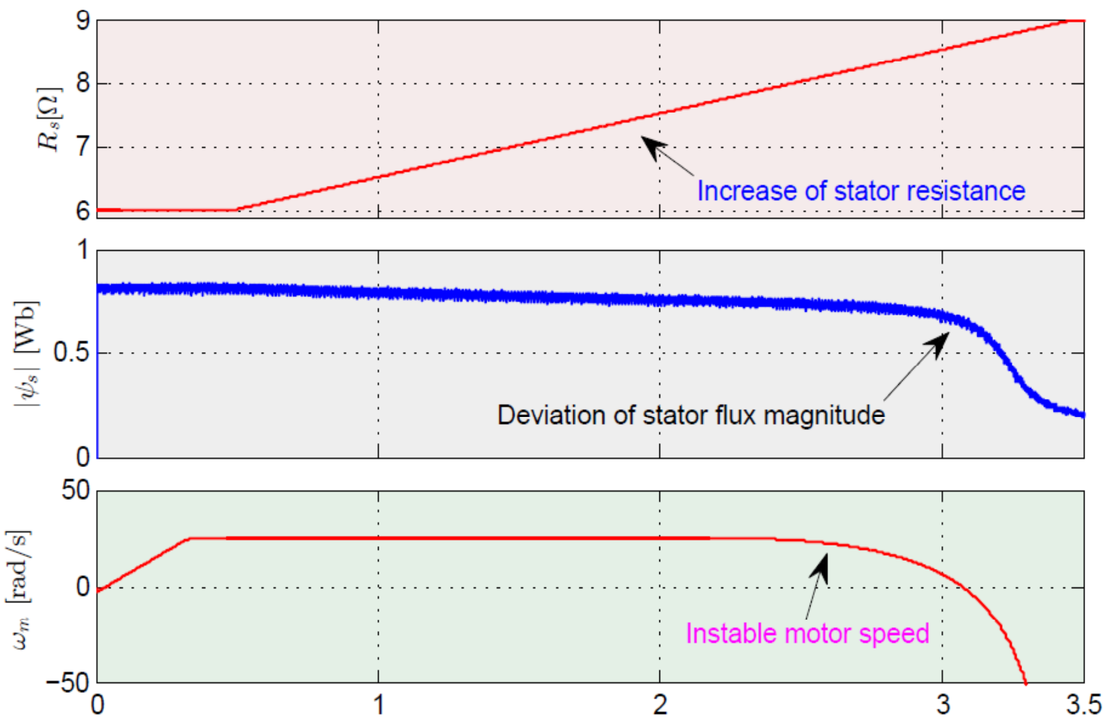
## 1. Problems statement

1. Voltage model based predictive torque control (PTC) of the induction motor (IM) drive provides poor performance in the low operating frequencies due to the increase of stator resistance.

2. For this reason, the motor speed becomes instable in the low-frequency operation.

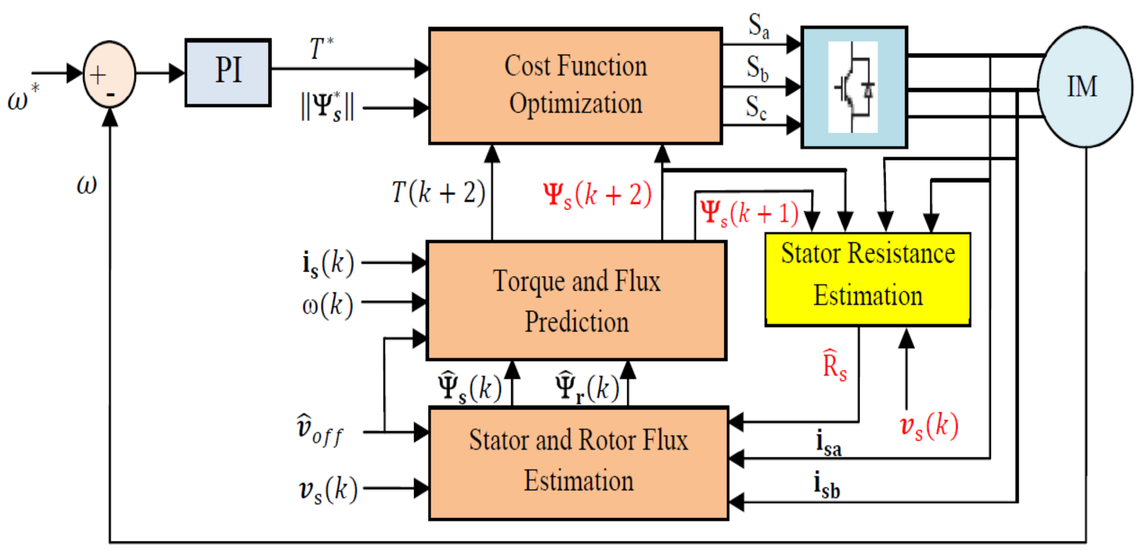
## 2. Negative effect of the increased resistance




## 3. Solution of the problems

Stator resistance should be predicted online based on the predicted stator flux, and rotor resistance should also be changed accordingly.

## 4. Proposed control scheme




### 4.1 Stator resistance estimation

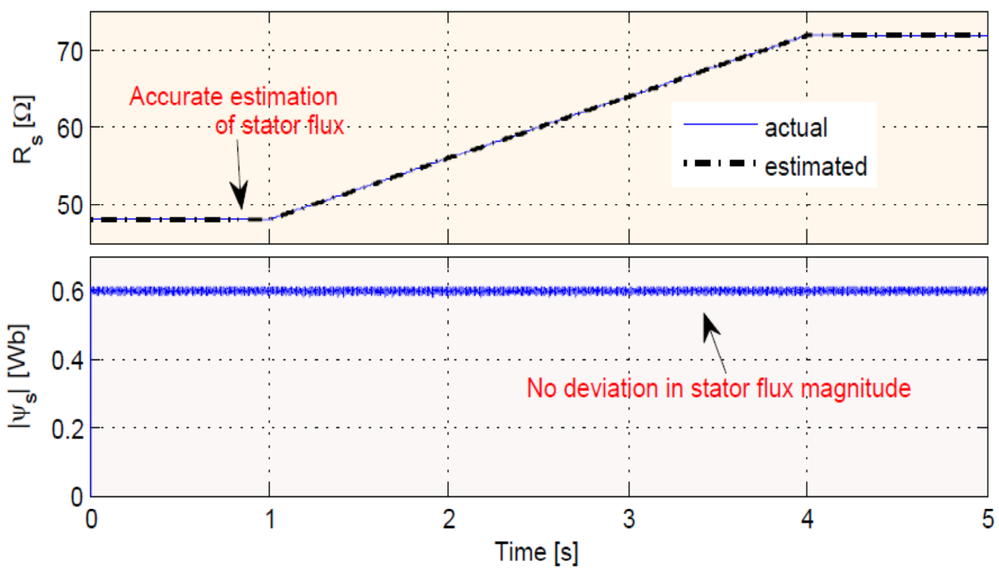
$$\hat{R}_s(k) = \left| \frac{\vec{v}_s(k)}{\vec{i}_s(k)} - \frac{\vec{\psi}_s(k+1) - \vec{\psi}_s(k)}{T_s} \cdot \frac{1}{\vec{i}_s(k)} \right|$$

**If,** $\vec{i}_s(k) = 0, \quad \vec{i}_s(k) = \vec{i}_s(k-1)$ — **To avoid the singularity problem**

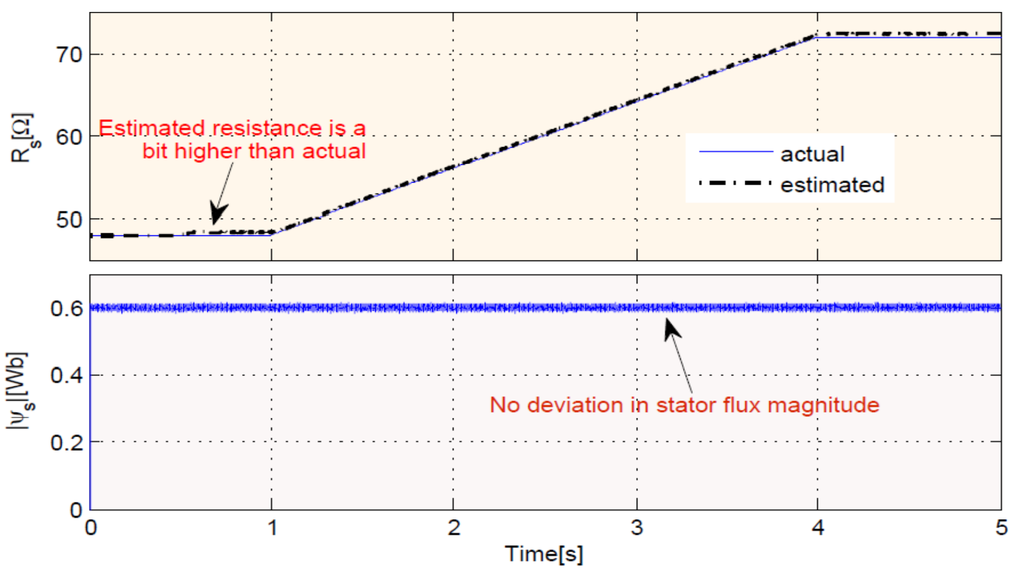
Rotor resistance is changed accordingly.

## 5. Results

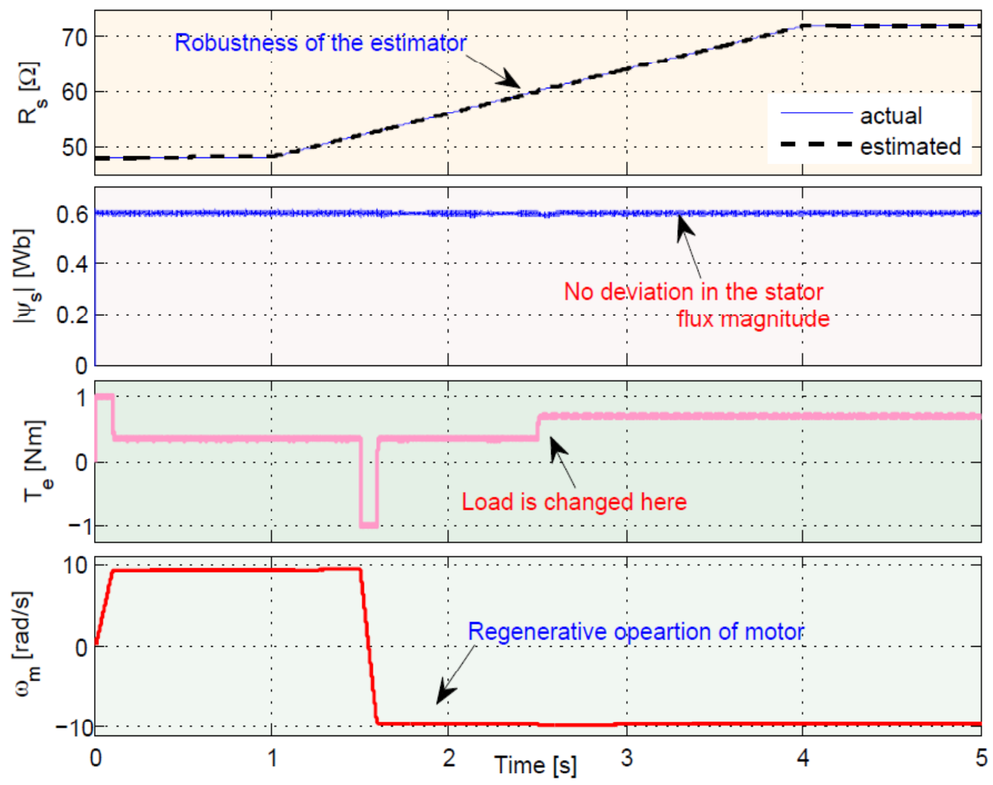
Motor operating at 0.5Hz.




Motor operating at 5Hz.




Motor operating at +/-3Hz under load change condition.




## 6. Discussions

1. Predicted stator flux is used to successfully avoid the dependency problem between the stator flux and the stator resistance.
2. The estimator eliminates the stator flux deviation problem, and it is more effective at low operating frequencies. However, it can be used at high operating frequencies.
3. The estimator is also robust under load change condition.