

Title

Author

Today

1 Block diagram

soon

2 Inputs and outputs

2.1 Inputs

Input	Symbol	Unit
Reactance current	I_q	A
Reluctance current	I_d	A
Coolant inlet temperature	T_{in}	°C
Coolant mass flow rate	\dot{m}_{in}	$\frac{kg}{sec}$

2.2 Outputs

Output	Symbol	Unit
Motor torque	τ	N m
Motor back-emf	E_m	V
Motor temperature	T_m	°C
Coolant outlet temperature	T_{out}	°C

3 Background, rationale, modeling strategy

3.1 Torque model

The motor is modeled using an empirical torque mapping, which assumes that the torque produced by the motor is a function of the input currents I_d and I_q , as well as the motor efficiency:

$$\tau = f(I_d, I_q) * \eta \quad (1)$$

The motor torque mapping $f(I_d, I_q)$ is determined empirically, and represented in the model as an interpolated 2D lookup table.

The lookup table approach allows for motor physical behavior, such as magnetic saturation and saliency, to be represented without calculating them directly.

3.2 Efficiency model

The motor efficiency is defined as the ratio between the output mechanical power and the input electrical power:

$$\eta = \frac{P_m}{P_e} = \frac{V_{app} I_{rms} ??}{\tau \omega} \quad (2)$$

where V_{app} is the applied voltage (line-to-line or phase?), I_{rms} is the motor current (same) and ω is the motor speed.

The motor efficiency is determined experimentally and represented as a lookup table:

$$\eta = g(I_{rms}, \omega?, \dots?) \quad (3)$$

4 Parameters

5 Assumptions