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MACROMODEL INDUCTION MOTOR ON EXPERIMENTAL DATA

Experimental transfer characteristics of three-phase motor A051-4A, Pw = 4.5 kW, voltage 220V. Induction motor is presented "black box." Input signal - moment of mechanical load on the motor shaft *S*. Output signals - a supply current of one of the phases *I* and rotor speed *W*.

Macromodel is created for RMS current *Is* and the average over the period 0.02 sec values speed *Ws*. Macromodel equations is two differential equations for state variables *Is* and *Ws*:

$$dIs/dt=K_{I1}+K_{I2}*S+K_{I3}*Is+K_{I4}*S^2+K_{I5}*S*Is+K_{I6}*Is^2+K_{I7}*Is^3+K_{I8}*Is^4+K_{I9}*Is^5;$$
$$dWs/dt=K_{W1}+K_{W2}*S+K_{W3}*Ws+K_{W4}*S^2+K_{W5}*S*Ws+K_{W6}*Ws^2+K_{W7}*Ws^3+K_{W8}*Ws^4+K_{W9}*Ws^5. \quad (1)$$

Identification macromodel (1) is a minimum mean-square residuals of equations (1) at all time points t_i [1]:

$$\min_{K_I}\sum_{i=1}^{357}(dIs(t_i)/dt-\sum_{j=1}^{9}K_{Ij}*S(t_i)^m*Is(t_i)^n)^2;$$
$$\min_{K_W}\sum_{i=1}^{357}(dWs(t_i)/dt-\sum_{j=1}^{9}K_{Wj}*S(t_i)^m*Ws(t_i)^n)^2. \quad (2)$$

To solve problem (2), except $S(t_i)$, $Is(t_i)$, $Ws(t_i)$ must have $dIs(t_i)/dt$ and $dWs(t_i)/dt$. At 357 values of $Is(t_i)$, $Ws(t_i)$ constructed a cubic smoothing splines. Derivative $dIs(t_i)/dt$ and $dWs(t_i)/dt$ found analytically splines differentiating.

Problems (2) are simple, for their successful solution does not require regularization. Found 18 factors substituted in the macromodel differential equation (1).

Solutions of equations (1) is well consistent with the experimental signals *Is* and *Ws*. Rms relative errors is less than 1%.

Macromodel induction motor is very simple and satisfactorily reproduces the experimental transient response. However macromodel with other input and output signals must identify all repeat again.

Applications are available at the author e-mail matv@ua.fm.

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