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Appendix

The parameters of the machine used for simulation are listed below [13]:

| | |
|---|--|
| Resistance of stator and rotor $R_s=7.58\Omega, R_r=6.3\Omega$ | 50(Hz) Stator frequency |
| $N_s=160$ Number of turns per stator phase | $N_r=16$ Number of rotor bars |
| $J=0.0054(Kgm^2)$ Inertia | $p=2$ Poles number |
| $R_b=0.00015(\Omega)$ Resistance of a rotor bar | $R_e=0.00015(\Omega)$ Resistance of end ring segment |
| $L_e=0.1e-6(H)$ Leakage inductance of end ring | $L_b=0.1e-6H$ Rotor bar inductance |
| $L=65(mm)$ Length of the rotor | $E=25(mm)$ Air-gap mean diameter |
| $L_{1s}=0.0265(H)$ Mutual inductance | $P=1.1(kW)$ Output power |

NOMENCLATURE

| Abbreviations | Designation |
|------------------|---|
| FL2SMC | Fuzzy Logic Type-2 sliding mode Controller |
| SMC | sliding mode control |
| IM | Induction Motor |
| ds-qs | Stationary reference frame direct and quadrature axes |
| Type-2 FLC | type-2 Fuzzy Logic Controllers |
| PWM | Pulse Width Modulation |
| RFL2 | Regulator Fuzzy Logic type-2 |
| V_s | Stator voltage |
| I_s, I_r | Stator and rotor current |
| L_s, L_r, L_m | Stator, rotor and mutual inductance |
| Ω_r | the rotor angular speed |
| C_e | Electromagnetic torque |
| Φ_s, Φ_r | Stator and rotor flux |
| R_s, R_r | Stator and rotor resistances |
| Θ_s | Angle between stator and rotor flux |
| p | Number of pole pairs |