Electr Eng
DOI 10.1007/s00202-016-0376-3

ORIGINAL PAPER

Comparison performance between sliding mode control and nonlinear control, application to induction motor

A. Oukaci[1] · **R. Toufouti**[2] · **D. Dib**[3] · **L. Atarsia**[2]

Received: 17 July 2014 / Accepted: 9 May 2016

Abstract A squirrel cage induction motor has been the workhorse in industry for variable speed applications in a wide power range that covers from fractional horsepower to multi megawatts. But the control and estimation of ac drives in general are considerably more complex than those of dc drives. The advent of vector control techniques has partially solved induction motor control problems. However, these techniques are very sensitive to the variation of motor parameters, result in an undesirable coupling between the flux and the torque of the machine, and loss of dynamic performance. To solve these problems this paper presents a synthesis of two control strategies, for controlling speed and rotor flux of induction motor (IM) via nonlinear control (NLC) and sliding mode control (SMC). Computer simulations are carried out to show the robustness of the proposed method against rotor resistance and load torque variations. The performance of SMC has been successfully compared with nonlinear control.

Keywords Induction motor · Non-linear control · Input output linearization control Nonlinear sliding surface · Sliding mode control

Nomenclature

r, s	Subscripts stand for rotor and stator
R_r, R_s	Rotor and stator resistances
L_r, L_s, M	Rotor, stator and mutual inductances
v_s,i_s	Voltage and current
Ω	Rotation's speed electric
p	Number of poles pair
J	Moment of inertia
T_{em}	Electromagnetic torque
σ	Total leakage coefficient
Φ_r	Flux module
ω_{s}	Synchronous rotating angular speed
T_L	Load torque

1 Introduction

Induction machines have been the workhorse in industry for variable speed applications due to their reliability, simplicity of design, the absence of the collector brooms system, low maintenance, and relatively low cost. However, despite these advantages, the control and estimation of ac drives in general are considerably more complex for many reasons: these are multivariable and highly nonlinear systems, the rotor flux is not usually measurable, and some of their parameters are time-varying. Due to the advancement of power electronics, the invention of power electronics, and digital signal processing (DSP), has made a radical revolution. Its goal is to develop different control strategies for induction motors,

✉ D. Dib
dibdjalel@gmail.com

A. Oukaci
assia_oukaci@yahoo.fr

R. Toufouti
toufoutidz@yahoo.fr

L. Atarsia
atarsia_loubna@yahoo.com

[1] University Mentouri of Constantine, Constantine, Algeria

[2] University Cherif Mesaadi of Souk Ahras, Souk Ahras, Algeria

[3] Department of Electrical Engineering, University Larbi Tebessi of Tebessa, Tebessa, Algeria

Published online: 10 June 2016