

Performance of direct torque control implemented in speed drive

Abstract

During the last decades, the rapid development of power semiconductor devices has allowed the increased use of adjustable speed ac drives in a variety of applications, especially in the process-control industry. In many applications, the capability of controlling the speed effectively can improve the efficiency of the ac motors and thus lead to large savings in energy. Among the several approaches used to control ac motors is the direct torque control (DTC), occupies an important place. DTC of ac motors is known to have very favorable control performance and implementation properties. The control scheme is based on the control of torque and flux utilizing the stator flux field orientation. Field orientation is achieved using advanced motor theory to calculate the torque directly and without using modulation. DTC enables the control of speed and torque over a very broad range. The torque response is particularly fast and it is possible to maintain constant speed, even when the mechanical load imposes sudden and unexpected mechanical shock. Thus the advancement of this ac drive technology enables the machine to achieve excellent dynamic performance. This paper is an attempt to investigate and evaluate the characteristics and operating principle of DTC scheme. Experimental tests have been carried out using ABB speed drive unit (ACS800 model), squirrel-cage induction motor and three-phase pendulum machine with integrated torque pick-up to validate the effectiveness and feasibilities of this controlling technique.