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FEED-FORWARD NEURAL NETWORK FOR DIRECT TORQUE CONTROL OF INDUCTION MOTOR

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Abstract. *PI controllers have been widely used in industrial systems application, because they have a simple structure and offer a satisfactory performance for a wide range operation. However, for varieties of plant parameters and the nonlinear operating condition, fixed gain PI controllers cannot provide the desired control performance. In this paper, advanced PI controller was utilized to control the speed of the induction motor in Direct Torque Control (DTC) for electric propulsion application. The proposed method is developed from conventional PI controller combined with feed-forward neural networks (FFNN). The FFNN is used to tune the gain of PI controller. The effectiveness of the complete proposed control scheme is clarified with a variation of speed reference and load torque applied to the motor. Load torque of induction motor depends on the speed rotation and pitch of propeller. Simulation results show the FFNN tuning technique provides better speed control performance.*
Keywords: PI controller, Direct torque control, Neural network, Electric propulsion

1. **Introduction.** Recently, there are many applications of electrical energy used for transportation system especially in marine transportation system. One of them is electric propulsion system. In this system, electric motor is used as prime mover to produce the ship propulsion. The induction motor is the most commonly used in the propulsion system to convert an electrical power to mechanical power because it can be directly connected to the electric network. In the propulsion system, induction motor is directly coupled with propeller of the ship [1-4]. In addition, induction motor has many advantages such as simply in construction, reliable, flexible, inexpensive, high efficiency, fast response and free maintenance [5]. However, induction motor is difficult to maintain a constant speed whenever the load is changed. Actually, there are several methods to solve such kind of problems. Field oriented control (FOC) or vector control method is one of the popular methods to solve the problem. FOC is a field regulation method of AC motor by changing coupled system to decoupled system. By this method, the excitation current and load current can be controlled separately. Hence, flux and torque also can be separately controlled similar in DC motor [5-7].