ABSTRACT

Induction motors are more significant in industry based applications due to the benefit of simple structure, robustness and high reliability. More specifically, three-phase induction motors are the most commonly used electric motors in industry. In order to fulfill most of the industrial necessities, the 3-phase induction motors are plain, rugged, low-priced, easy to sustain and is factory-made with characteristics. Induction motors work in constant speed from no-load to full-load. Induction motors are more well-known in use of household materials, commercial and various industrial applications. With these various advantages of induction motors, a very high place is hold in industrial parts. But, the much use of induction motors in the industry leads to lack of electric power with lower efficiency. The enhancement of efficiency and power factor through a better motor design becomes a major challenge.

Most of the existing techniques fail to achieve high efficiency and power factor in conventional models. Perhaps low efficiency causes more energy consumption as well as low power factor results in more intakes of transmission energy and non-optimal use of inverter. The efficiency of an induction motor system is a serious function of the motor, converter, and
control system. Various scenarios are developed for improving the efficiency and power factor of induction motor. The conventional control of an induction motor is complex due to tough nonlinear magnetic saturation impacts and temperature dependence of the motors electrical parameters. Additionally, the conservative optimization method is inappropriate to deliver a better search effects on deriving optimal solution. Therefore, an effective combination is required to maintain higher parameter optimization of induction motors.

Initially in this first research work, an integrated technique termed enhanced Artificial Bee Colony (ABC) is developed to maximize the efficiency and power factor of induction motor through combination of standard ABC and Fuzzy Logic Control (FLC) technique. Enhanced ABC method employs standard ABC algorithm to optimize the induction motor’s parameters like efficiency and power factor at particular loading points. The exact stator, rotor resistance and reactance parameters are predictable using FLC while the parameter variation at various loading conditions. In addition, FLC along with control technique avoids stator losses to maximize about 2-4% efficiency and power factor of three phase induction motors.

The latter part of the research work concentrates on search accuracy for the overall optimum or quasi-optimums of induction motor design within a sensible computation time on the proposal of Genetic Algorithm (GA). Generally, GA is an optimal design method to optimize induction motor in built-up process which focus on enhancement of efficiency
and power factor of the motor. More specifically, GA is used for optimization and objective functions like power factor and efficiency with reduced cost. The motor design procedure involves a system of non-linear equations, which imposes induction motor features, motor performance, objective functions and fitness function. Experimental evaluations are done in MATLAB Platform and the results prove 1-2% high effectiveness of the GA design process in terms of power factor.

The last part of the research work focuses on still improving efficiency and power factor of the induction motor through combination of enhanced ABC with GA. Enhanced ABC with an aid of Genetic Algorithm (GA) optimize the induction motor’s parameters at various loading points. Enhanced ABC performs the operations of both standard ABC algorithm and Fuzzy Logic Control (FLC). In the enhanced ABC algorithm, bees generate new solution for the input parameters using GA. In the proposed system, GA is useful for controlling the frequency of perturbation and improving the searching accuracy of enhanced ABC. Enhanced ABC with GA is used to provide the exact parameters from the optimized parameter values for all type of loading conditions. The parameters of induction motors are determined from the current, voltage, power loss and stray load losses. Enhanced ABC with GA is implemented in MATLAB platform and performance is evaluated. The performance of the proposed method is improved to about 1-3% better power factor and 1-5% higher efficiency in contrast to other existing methods.