Abstract

1. First of all, this lecture presents research experience such as immune system, genetic algorithm, particle swarm optimization, bacterial foraging, and its hybrid system and application to real system. This lecture will also show research experience and results of emotion for emotion robot by AI. From research experience, immune system, PSO (Particle Swarm Optimization), BF (Bacteria Foraging), and hybrid system can have strong optimization function for engineering fields. In detailed description, this lecture describes research background about immune network based intelligent algorithm, PSO based intelligent algorithm, bacteria foraging based intelligent algorithm, and the characteristic of novel algorithm fusioned by their algorithm. This one also illustrates motivation and background that these algorithms should be applied to in the industry's automatic system.

2. Second, this lecture illustrates immune algorithm and applied to various plant to investigate the characteristics and possibility of application. As the detailed description, immune algorithm will described by studied material to investigate possibility of application to plant. It suggests condition for disturbance rejection control in AVR of thermal power plant and introduce first into tuning method of its controller.

   In the conventional genetic algorithm, it takes a long time to compute and could not include a variety of information of plant because of using sequential computing methods. That is some problem with making a artificial intelligence for optimization. In this lecture, by means of introducing clonal selection of immune algorithm into computing procedure, it will be showed advanced results. That is, it can be calculated simultaneously necessary information, transfer function, time constant, and etc., for plant operation condition. Therefore, computing time is about 30% shorter than that of the conventional genetic algorithm and 10.6% smaller in overshoot when it is applied to controller.

3. This lecture will introduce parameter estimation method by immune algorithm for obtaining model of induction motor. It will suggest immune algorithm based induction motor parameter estimation to obtain optimal value depending on load variation from these parameters.

4. Also, this lecture will introduce about intelligent system using GA-PSO. It will introduce Euclidean data distance to obtain fast global optimization not local optimization by means of using wide data and
suggests novel hybrid system GA-PSO based intelligent tuning method that genetic algorithm and PSO (Particle Swarm Optimization) is fused.

To prove this effectiveness, four test functions are used and results of Rosenbrock function, one of four test functions, converges at 20 generations in GA-PSO and at 40 generations in genetic algorithm, as result GA-PSO reveals faster running time than that of GA. The suggested method is applied to tuning of automatic controller for terminal voltage regulation of AVR (Automatic Voltage Regulator) of thermal power plant. Results reveal best response at 100 generations and results show 6.8331% error in GA, 5.3828% error (78.8%; reduced) in GA-PSO, in case of overshoot. In case of steady state error, results illustrate reduced error with 0.0028% error (16.4%; reduced) with 0.0171% in GA and 0.0143% in GA-PSO. In settling time, it represents 0.557(sec) in GA and 0.3989(sec) in GA-PSO and it reduce to 0.159(sec) (28.5%) by using GA-PSO. In the case of rise time, results shows 0.2037(sec) in GA and 0.2639(sec) in GA-PSO and tuning results are better than that of conventional method.

5. This lecture shows novel hybrid system structured by GA-BF (Genetic- Bacterial Foraging) that firstly search wide area by GA and secondly optimize parameters precisely by BF (Bacterial Foraging) to enhance divergence speed and optimal accuracy, and prove effectiveness of the suggested hybrid system on various test function. In Rosenbrock function, GA converges at 40 generations and GA-BF has already done at 5 generations. That means the suggested hybrid system shows faster response of 35 generations. When this suggested hybrid system is applied to AVR (Automatic Voltage Regulator), there is no overshoot and fast settling time. In induction motor vector PI control system, as error of speed following efficiency is $1.7371 \times 10^{-6}$ in the conventional and $1.4251 \times 10^{-6}$ in GA-BF, error by the suggested hybrid system is smaller about 18%.

6. However, we have some questions why we have to study not introducing emotion function because emotion function can give an impact on decision making as they mentioned earlier. So, this lecture will mention how we can research for artificial intelligence and robot by using studied materials up to now. Especially, robots are becoming more and more ubiquitous in human environments as emerging technology for economic growth. Artificial intelligence will be decided by our ability to express effectively human’s mind such as intelligence and emotion. That is, emotion-inspired mechanisms will deal with importance for autonomous robots in a human environment, and also related works may be studied.

Of course, the cognitive component is important for perceiving and interpreting events. To implement emotion function in robot, there are several approaches to soft computing and control algorithm to control effectively robot. However, many of them do not deal with emotion function in their soft computing algorithm. So, at this point, fusion of soft computing and emotional function should be introduced into the research method and real control system such as, robot, ICT, design, and so on.

Herein, we develop the corresponding fusion algorithms or models with learning algorithms including emotion function. Next, applications of these soft computing-based AIS (Artificial Intelligence Soft computing) in driver and expression system should be considered and analyzed. Performance comparisons between the conventional methods and new solutions should be made for safety and real artificial intelligence.

Finally, the presenter poses the following questions:
Do we continue our research in AI?
Where do we expect new ideas to emerge from?
Natural systems provide the answers!

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