Preface

This book contains articles from the four issues of Volume 1 of the *International Journal of Applied Evolutionary Computation* (IJAEC). As mentioned in journal’s description, this book reflects the journal’s mission of publishing high-quality comprehensive interdisciplinary academic and practitioner research, and surveys that provide a reference channel for disseminating all experimental, theoretical and application emerging aspects of intelligent computation (IC) and its applications, with particular focus on breaking trends in evolutionary computation, evolutionary algorithms, evolutionary programming, fuzzy computation, neural computation, traditional probabilistic computation, and their industrial applications. Over the last years, EC in its various forms has emerged as one of the major topics in the scientific community and many EC techniques have been successfully applied to solve problems in a wide variety of fields. These articles also reflect the journal’s objective of dedicating to provide a exchangeable forum academically and high quality results for innovative topics, trends and research in the field of EC, to succeed in expanding the fields and depths the most principal and critical concepts that will form the applications from EC more matured in the future.

*IJAEC* is intended to serve and support scientists, professionals, entrepreneurs, government employees, policy and decision makers, educators, students, and all people who are working in this scientific field or who are interested in considering and using EC techniques for their specific applications. This academic resource dedicates to provide international audiences with the highest quality research manuscripts in emphasizing computational results which have been are ideally put in the context of algorithm design; in addition, purely theoretical papers will also be encouraged. Researchers, academicians, practitioners and students will find this journal as a critical source of reference for all advanced intelligent computational applications and developments. On the other hand, along with the tremendous development in complicated public economic and business operations, EC has also been viewed as a great application and a solution to solve in a variety of business modelling. *IJAEC* is also devoted to data analysis and applications and tools used for business modelling, including all areas of pattern recognition, forecasting, classification, optimization cluster, bio-inspired systems and novel applications. A summary of the scope of IJAEC includes:

1. **Intelligent techniques**: Fuzzy computing, neural computing, and evolutionary computing; evolutionary algorithms (genetic algorithms, simulated annealing algorithms,…); evolutionary programming; probabilistic computing; immunological computing; grid computing; natural computing; expert and hybrid systems (methods); Chaos theory; and other intelligent techniques (interactive computational models);
2. **Data analysis:** Classification, regression, and optimization cluster; decision support system; statistical pattern recognition; signal or image processing;

3. **Applications and tools:** Vision or pattern recognition, time series forecasting; biomedical engineering; manufacturing systems; power and energy; data mining; data visualization; bio-inspired systems and tools and applications.

The first article in the inaugural issue of IJAEC, entitled “Ant Clustering Algorithms” by Chiou from NCTU (Taiwan) and Chou from Feng Chia University (Taiwan), of which one of the journal editors (Chiou) is a coauthor, proposes three ant clustering algorithms (ACAs) to modify the ant colony meta-heuristic by reformulating the clustering problem into a network problem. The solution effectiveness at different problem scales consistently shows that ACA-2 outperforms other alternative clustering methods, including agglomerative hierarchy clustering algorithm (AHCA), K-means algorithm (KMA) and genetic clustering algorithm (GCA), in the meanwhile, ACA-2 also performs considerably better in solution stability as the problem scales or the number of clusters gets larger.

The second article of this issue, entitled “Three Novel Methods to Predict Traffic Time Series in Reconstructed State Spaces” by Lan from Ta Hwa Institute of Technology (Taiwan), Lin from Central Police University (Taiwan), and Kuo from University of Maryland (USA), of which one of the journal editors (Lan) is a coauthor, deals with a more applicative topic, and embeds one-dimensional historical traffic series into appropriate multidimensional state spaces by Takens’ algorithm and then to perform fuzzy reasoning to infer the future changes in traffic series based on the latest observed traffic vector. Three novel methods, called temporal confined (TC), spatiotemporal confined (STC) and spatial confined (SC) methods respectively employ different fuzzy reasoning logics to select “temporal similarity,” “spatiotemporal similarity,” and “spatial similarity” of historical traffic trajectories, which are confined by designated temporal, spatiotemporal, and spatial domains. The results show that the overall prediction accuracies for these three novel methods are satisfactorily high.

The third article of the issue, entitled “Self-Evolvable Protocol Design Using Genetic Algorithms” by Yao from Huawei Technologies (UK), Guan from Xian Jiatong-Liverpool University (China), Jiang from National University of Singapore (Singapore), and Kiourktsidis from Brunel (UK), of which one of the journal editors (Guan) is a coauthor, applies Genetic algorithms (GAs) to design an evolvable protocol, one of the Self-modifying protocols (SMP) designed which can be modified at run time so that they can adapt to the changing communicating environment and user requirements on the fly, in order to equip communication peers with more autonomy and intelligence. They then use the Network Simulator (NS2) to evaluate this evolvable protocol module to demonstrate the feasibility of our new design approach.

The final article of this issue, entitled “Facial Feature Tracking via Evolutionary Multiobjective Optimization” by Larson and Yen both from Oklahoma State University (USA), of which one of the journal editors (Yen) is a coauthor, describes an application of traditional pattern recognition in facial feature tracking, which has received considerable attention in recent decades for its applications in video gaming, interaction, and numerous other disciplines. Of particular interest is its application in very low bit rate coding in which optimization is used to analyze head and shoulder sequences; they present a combination of non-dominated sorting genetic algorithm and a deterministic search to find optimal facial animation parameters at many bandwidths simultaneously. The results show that the overall methodology works effectively and reliably.

The first article of Volume 1, Issue 2, entitled “Ordered Incremental Multi-Objective Problem Solving Based on Genetic Algorithms” by Mo from IBM (Singapore), Guan from Xian Jiatong-Liverpool
University (China), and Puthusserypady from National University of Singapore (Singapore), of which one of the journal editors (Guan) is a coauthor, employs the incremental approach to normal multiple objective genetic algorithms (MOGA), namely IMOGA, in ordering issue investigation. Incremental approach can be used to enhance the performance of various MOGAs, which was developed to evolve each objective incrementally. Their experimental results on benchmark problems showed that the proposed approach can help IMOGA reach its potential best performance.

The second article of the issue, entitled “Comparative Study of Evolutionary Computing Methods for Parameter Estimation of Power Quality Signals” by Pandi and Panigrahi from IIT Delhi (India), of which one of the journal editors (Panigrahi) is a coauthor, presents an evolutionary algorithm approach based on adaptive particle swarm optimization (APSO) to determine the amplitude, phase and frequency of a power quality signal. Along with the sensitivity of load equipments to various power quality disturbances, power quality disturbance monitoring plays an important role in the deregulated power market scenario. They attempt to make to highlight the efficacy of different evolutionary optimization techniques like classical PSO, constriction based PSO, clonal algorithm (CLONALOG), adaptive bacterial foraging (ABF) and the proposed adaptive particle swarm optimization (APSO) to extract different parameters like amplitude, phase and frequency of harmonic distorted power quality signal and voltage flicker.

The third article, entitled “A Heuristic Approach for Multi Objective Distribution Feeder Reconfiguration: Using Fuzzy Sets in Normalization of Objective Functions” by Milani from Islamic Azad University (Iran), and Haghifam from Tarbiat Modarres University (Iran), firstly presents an algorithm for network reconfiguration based on the heuristic rules and fuzzy multi objective approach for the reconfiguration of switches in a distribution network, where each objective is normalized with inspiration from fuzzy set to cause optimization more flexible and formulized as a unique multi objective function. Secondly, genetic algorithm (GA) is used for solving the suggested model, in which there is no risk of non-linear objective functions and constraints. The effectiveness of the proposed method is demonstrated through several examples.

The final article of the second issue of 2010 is entitled “A Scheduling Model with Multi-Objective Optimization for Computational Grids using NSGA-II” and is written by Raza and Vidyarthi from Jawaharlal Nehru University (India). Their study describes an application of multi-objective optimization problem for scheduling a job on the grid. Genetic algorithm is an effective tool in solving problems that requires sub-optimal solutions and finds uses in multi-objective optimization problems. They addresses this problem by introducing a scheduling model for a modular job on a computational grid with the dual objective; minimizing the turnaround time and maximizing the reliability of the job execution using NSGA - II. Simulation study and a comparison of the results with other similar models reveal the effectiveness of the model.

The first Volume 1, Issue 3 article, “Extrapolated Biogeography-Based Optimization (eBBO) for Global Numerical Optimization and Microstrip Patch Antenna Design” by Lohokare, Pattnaik, Devi, and Joshi from National Institute of Technical Teachers’ Training and Research (India), Panigrahi from Indian Institute of Technology (India), and Das from Kansas State University (USA), of which one of the journal editors (Panigrahi) is a coauthor, extend the original biogeography-based optimization (BBO) and proposes a hybrid version combined with ePSO (particle swarm optimization with extrapolation technique), namely eBBO, for unconstrained global numerical optimization problems in the continuous domain. The BBO uses the idea of probabilistically sharing features between solutions based on the solutions’ fitness values. Therefore, its exploitation ability is good but it lacks in exploration ability. eBBO combines the exploitation ability of BBO with the exploration ability of ePSO effectively, which
can generate global optimum solutions. The experimental analysis of eBBO, by comparing with original BBO and other versions of BBO in terms of the quality of the final solution and the convergence rate, indicates that the proposed approach is effective and efficient and improves the exploration ability of BBO.

In “Posterior Sampling Using Particle Swarm Optimizers and Model Reduction Techniques,” the second article in Volume 1, Issue 3, by Martinez from Stanford University, University of California-Berkeley (USA) and University of Oviedo (Spain), Gonzalo and Muñiz from University of Oviedo (Spain), and Mariethoz and Mukerji from Stanford University (USA), presents a practical applications based on particle swarm optimizers and reduction techniques in the domain of environmental geophysics, where it provides a proxy for the posterior distribution when it is used in its explorative form to improve the drawbacks of Monte Carlo methods in solving inverse problems. The inverse problems are ill-posed and posterior sampling is a way of providing an estimate of the uncertainty based on a finite set of the family of models that fit the observed data within the same tolerance. Finally, this chapter also presents a hydrogeological example how to perform a similar task for inverse problems in high dimensional spaces through the combined use with model reduction techniques.

In the third article in Volume 1, Issue 3, “Reserve Constrained Multi-Area Economic Dispatch Employing Evolutionary Approach,” by Sharma and Pandit from M.I.T.S. (India), compares classic PSO and DE strategies and their variants for reserve constrained MAED (Multi-area economic dispatch). The objective of Multi-area economic dispatch (MAED) is to determine the generation levels and the interchange power between areas that minimize fuel costs, while satisfying power balance and generating limit and transmission constraints. If an area with excess power is not adjacent to a power deficient area, or the tie-line between the two areas is at transmission limit, it is necessary to find an alternative path between these two areas to transmit additional power. When a MAED problem is solved with spinning reserve constraints, the problem becomes further complicated. The power allocation to each unit is done in such a manner that after supplying the total load, some specified reserve is left behind. The performance is tested on a 2-area system having 4 generating units and a 4-area, 16-unit system.

In “Application of Machine Learning Techniques to Predict Software Reliability,” the final paper in Volume 1, No. 3, Mohanty, Patra from Berhampur University (India), and Ravi from Institute for Development and Research in Banking Technology (India) employ machine learning techniques, specifically, back propagation trained neural network (BPNN), group method of data handling (GMDH), counter propagation neural network (CPNN), dynamic evolving neuro–fuzzy inference system (DENFIS), genetic programming (GP), TreeNet, statistical multiple linear regression (MLR), and multivariate adaptive regression splines (MARS), to accurately forecast software reliability. The effectiveness of these models is demonstrated on three datasets taken from literature, where performance is compared in terms of normalized root mean square error (NRMSE) obtained in the test set. From rigorous experiments conducted, it was observed that GP outperformed all techniques in all datasets, with GMDH coming a close second.

In “Buffer Management in Cellular IP Networks Using Evolutionary Algorithms,” the first paper in Volume 1, No. 4, Anbar and Vidyarthi from Jawaharlal Nehru University (India) employ evolutionary algorithms (GA and PSO) to assist to manage buffers of the cellular IP networks. Authors propose a two-tier model for buffer (gateway and base station buffer) management in cellular IP network. The first tier applies a prioritization algorithm for prioritizing real-time packets in the buffer of the gateway with a specified threshold. The packets which couldn’t be served, after the threshold, is given to the nearest cells of the network to be dealt with in the second tier. Consequently, evolutionary algorithms are employed to optimally store these packets in the buffer of the base stations. Their experiments have depicted the advantage and disadvantage of the proposed models.
In the second paper in Volume 1, No. 4, “Using Evolution Strategies to Perform Stellar Population Synthesis for Galaxy Spectra from SDSS,” Gomez from Katholieke Universiteit Leuven (Belgium) and Fuentes from University of Texas at El Paso (USA) employ evolution strategies (ES) to automatically extract a set of physical parameters from a sample of galaxy spectra taken from the Sloan Digital Sky Survey (SDSS). They pose this parameter extraction as an optimization problem and then solve it using ES. The main idea is to reconstruct each galaxy spectrum by means of a linear combination of three different theoretical models for stellar population synthesis. The goal is to find a model that minimizes this difference using ES as the algorithm to explore the parameter space. Their experimental results show that ES are very well suited to extract stellar population parameters from galaxy spectra.

The third article in Volume 1, No. 4 is “A Novel Puzzle Based Compaction (PBC) Strategy for Enhancing the Utilization of Reconfigurable Resources” by Saleh from Mansoura University (Egypt). It introduces a novel puzzle based compaction (PBC) technique to overcome the faults, such as internal and external fragmentations, from traditional compaction techniques in Field Programmable Gate Array (FPGA) fields. PBC succeeded not only to eliminate the internal fragmentations but also to minimize the external fragmentations. Moreover, the author also develops a novel formula to exactly calculate the amount of external fragmentations generated by hosting a set of tasks inside the reconfigurable chip. Experimental results have shown that PBC outperforms recent compaction techniques in which the chip utilization has reached 87%.

For transmission network expansion planning with and without security constraints, the fourth paper in Volume 1, No. 4, entitled “A Comparative Study of Metaheuristic Methods for Transmission Network Expansion Planning,” by Verma from TERI University (India), Bijwe and Panigrahi from IIT (India), of which one of the journal editors (Panigrahi) is a coauthor, presents a comparative analysis of three metaheuristic algorithms, Bacteria foraging (BF), Genetic algorithm (GA) and Particle swarm optimization (PSO), for transmission network expansion planning with and without security constraints. Experimental results for IEEE 24 bus system are obtained with the above three metaheuristics and shown that BF method is a robust one and provides better results as compared to those with other two methods, in terms of least standard deviation and best convergence characteristics.

The articles in this compendium display a broad range of cutting edge topics in evolutionary algorithms, evolutionary programming, fuzzy computation, and neural computation. The preface author believes that hybrid evolutionary algorithms will play more important role in the evolutionary computation fields. These evolutionary algorithms almost have their theoretical drawbacks, such as lack of knowledge memory or storage functions, time consuming in training, and being trapped in local optimum, therefore, by hybridizing some novel search technique to adjust their internal parameters (e.g., mutation rate, crossover rate, annealing temperature, etc.) to overcome those mentioned shortcomings. Firstly, for example, in genetic algorithm (GA), new individuals are generated by the following operators, selection, crossover, and mutation. For all types of objective functions, the generation begins with a binary coding for the parameter set. Based on this special binary coding process, GA is able to solve some specified problems which are not easily to be solved by traditional algorithms. GA can empirically provide a few best fitted off-springs from the whole population, however, after some generations, due to low diversity of the population, it might lead to a premature convergence. Similarly, simulated annealing (SA) is a generic probabilistic search technique that simulates the material physical process of heating and controlled cooling. Each step of SA attempts to replace the current state by a random move. The new state may then be accepted with a probability that depends both on the difference between the corresponding function values and also on a global parameter, temperature. Thus, SA has some institu-
tion to reach more ideal solutions. However, SA costs lots of computation time in annealing process. To improve premature convergence and to receive more suitable objective function values, it is necessary to find some effective approach to overcome these drawbacks from GA and SA. Hybridization of genetic algorithm with simulated annealing (GA-SA) algorithm is an innovative trial by applying the superior capability of SA algorithm to reach more ideal solutions, and by employing the mutation process of GA to enhance searching process. GA-SA algorithm has been applied to the fields of system design (Shie & Peralta, 2005), system and network optimization (Zhao & Zeng, 2006), continuous-time production planning (Ganesh & Punniamoorthy, 2005), and electrical power districting problem (Bergey, Ragsdale, & Hoskote, 2003). Furthermore, due to easy implementation process and special mechanism to escape from local optimum (Wang, Zheng, & Lin, 2001), chaos and chaos-based searching algorithms have received intense attentions (Liu et al., 2005; Cai et al., 2007). Applications of chaotic sequence to carefully expand variable searching space, i.e., let variable travel ergodically over the searching space, are more and more popular to be employed in evolutionary computation fields.

Secondly, several disadvantages embedded in these evolutionary algorithms are required to be improved to get more satisfied performance. For example, based on the operation procedure of SA, subtle and skillful adjustment in the annealing schedule is required, such as the size of the temperature steps during annealing. Particularly, the temperature of each state is discrete and unchangeable, which does not meet the requirement of continuous decrease in temperature in actual physical annealing processes. In addition, SA is easy to accept deteriorate solution with high temperature, and it is hard to escape from local minimum trap with low temperature (Pin, Lin, & Zhang, 2009). To overcome these drawbacks of SA, the cloud theory is considered. Cloud theory is a model of the uncertainty transformation between quantitative representation and qualitative concept using language value (Deyi, Haijin, & Xuemei, 1995). It is successfully used in intelligence control (Deyi et al., 1998; Feizhou et al., 1999), data mining (Shuliang et al., 2003), spatial analysis (Hajun & Yu, 2007), intelligent algorithm improvement (Yunfang, Chaohua, & Weirong, 2005), and so on. Based on the operation procedure of SA, subtle and skillful adjustment in the annealing schedule is required, such as the size of the temperature steps during annealing, the temperature range, the number of re-starts and re-direction of the search, the annealing process is like a fuzzy system in which the molecules move from large scale to small scale randomly as the temperature decreases. In addition, due to its Monte Carlo scheme and lacking of knowledge memory functions, time consuming is also an another boring problem. Author has tried to employ chaotic simulated annealing (CSA) algorithm, to overcome these shortcomings. In which, the transiently chaotic dynamics are temporarily generated for foraging and self-organizing, then, gradually vanished with autonomous decreasing of the temperature, and are accompanied by successive bifurcations and converged to a stable equilibrium. Therefore, CSA has significantly improved the randomization of Monte Carlo scheme, and, has controlled the convergent process by bifurcation structures instead of stochastic “thermal” fluctuations, eventually, performed efficient searching including a global optimum state. However, as mentioned that the temperature of each state is discrete and unchangeable, which does not meet the requirement of continuous decrease in temperature in actual physical annealing processes. Even some temperature annealing function is exponential in general, the temperature is gradually falling with a fixed value in every annealing step and the changing process of temperature between two neighbor steps is not continuous. This phenomenon also appears while other types of temperature update functions are implemented, such as arithmetical, geometrical or logarithmic one. In the cloud theory, by introducing the Y condition normal cloud generator to the temperature generation process, it can randomly generate a group of new values that distribute around the given value like “cloud”. Let the fixed
temperature point of each step become a changeable temperature zone in which the temperature of each state generation in every annealing step is chosen randomly, the course of temperature changing in the whole annealing process is nearly continuous and fits the physical annealing process better. Therefore, based on chaotic sequence and cloud theory, the CCSA is employed to replace the stochastic “thermal” fluctuations control from traditional SA, to enhance the continuously physical temperature annealing process from CSA. The cloud theory can realize the transformation between a qualitative concept in words and its numerical representation. It is able to be employed to avoid problems mentioned above.

Thirdly, the concepts of combined or hybrid models are also deserved to be considered. Please notice that the so-called hybrid model means that some process of the former model is integrated into the process of the later one, for example, hybrid A and B implies some process of A are controlled by A, some are by B. On the other hand, for the so-called combined model, it only indicated that the output of the former model is then the input of the later one, therefore, the classification results from combined models will be superior to single model. Based on this knowledge, please check clearly which types (hybrid model or combined model) your proposed model is. The combined models are employed to further capture more data pattern information from the analyzed data series. For example, inspired by the concept of recurrent neural networks (RNNs) that every unit is considered as an output of the network and the provision of adjusted information as input in a training process (Kechriotis, Zervas, & Manolakos, 1994), the recurrent learning mechanism framework is also combined into the original analyzed model. For a feed-forward neural network, links may be established within layers of a neural network. These types of networks are called recurrent neural networks. RNNs are extensively applied in time series forecasting. Jordan (Jordan, 1987) proposes a recurrent neural network model (Figure 1) for controlling robots. Elman (Elman, 1990) develops a recurrent neural network model (Figure 2) to solve linguistics problems. Williams and Zipser (Williams & Zipser, 1989) present a recurrent network model (Figure 3) to solve nonlinear adaptive filtering and pattern recognition problems. These three models mentioned all consist of multilayer perceptron (MLP) with a hidden layer. Jordan networks have a feedback loop from the output layer with past values to an additional input, namely “context layer”. Then, output values from the context layer are fed back into the hidden layer. Elman networks have a feedback loop from the hidden layer to the context layer. In Williams and Zipser networks, nodes in the hidden layer are fully connected to each other. Both Jordan and Elman networks include an additional information source from the output layer or the hidden layer. Hence, these models use mainly past information to capture detailed information. Williams and Zipser networks take much more information from the hidden layer and back into themselves. Therefore, Williams and Zipser networks are sensitive when models are implemented (Tsoi & Back, 1994). For another combined model, on the other hand, some data series sometimes reveals a seasonal tendency due to cyclic economic activities or seasonal nature hour to hour, day to day, week to week, month to month, and season to season, such as hourly peak in a working day, weekly peak in a business week, and monthly peak in a demand planned year. In order to excellently deal with cyclic/seasonal trend data series, some useful trial, e.g., seasonal mechanism (Azadeh & Ghaderi, 2008; Deo & Hurvich, 2006) is also received some intentions.

Based on the discussions above, it will also become another research tendency in evolutionary computation, that is, evolutionary algorithms support systems to guide researchers how to use proper evolutionary algorithms in parameters determination for their analysis models. This is because that for any analysis models (including classification model, forecasting model, and so on), the most important problem is how to catch the data pattern, and applied the learned patterns or rules to receive satisfied performance, i.e., the key successful factor is how to suitably look for data pattern. The data pattern
could be classified into three categories, (1) fluctuation: changing violently according to policy, or herding behaviors of investors; (2) regular pattern: annual increasing or decreasing tendency, or seasonality/cyclic; (3) noise: accidental events (e.g., 911 event, SARS event), or man-made events (e.g., product promotion event). However, each model itself has excelled ability to catch specific data pattern. For example, exponential smoothing and ARIMA models focus on strict increasing (or decreasing) time
series data, i.e., linear pattern, even they have seasonal modification mechanism to analyze seasonal (cyclic) change; due to artificial learning function to adjust the suitable training rules, ANN model is excelled only if historical data pattern has been learned, it is lacks of systematic explanation how the accurate forecasting results are obtained; support vector regression (SVR) model could acquire superior performance only if proper parameters determination search algorithms. Therefore, it is essential to construct an inference system to collect the characteristic rules to determine the data pattern category. Secondly, it should assign appropriate approach to implement forecasting: for (1) ARIMA or exponential smoothing approaches, the only work is to adjust their differential or seasonal parameters; (2) ANN or SVR models, the forthcoming problem is how to determine best parameters combination (e.g., numbers of hidden layer, units of each layer, learning rate; or hyper-parameters) to acquire superior forecasting performance. Particularly, for the focus of this discussion, in order to determine the most proper parameter combination, a series of evolutionary algorithms should be employed to test which data pattern is familiar with, such as genetic algorithms (GA), simulated annealing algorithms (SA), ant colony optimization (ACO), Tabu search (TA), immune algorithm (IA), and particle swarm optimization algorithm (PSO). Based on experimental findings, those evolutionary algorithms themselves also have merits and drawbacks, for example, GA and IA could handle excellently in regular trend data pattern (real number) (Pai & Hong, 2005), SA excelled in fluctuation or noise data pattern (real number) (Pai & Hong, 2005b, 2006), TA is good in regular cyclic data pattern (real number) (Hong et al., 2006), and ACO is well done in integer number searching.

As aforementioned, it is possible to propose an intelligent support system to improve the usage efficiency of evolutionary algorithms hybridized in the analysis model, namely evolutionary algorithms support system (EASS). The main flow chart of the EASS suggested in this conclusion is given in Figure 4. Firstly, employ fuzzy logic to construct the inference system to pre-process the time series data, and find out or define the characteristic rules set of data pattern, such as linear, logarithmic, inverse,
quadratic, cubic, compound, power, growth, exponential, etc. Secondly, filter the original data by those data pattern rules set, then, recognize the appropriate data pattern (fluctuation, regular, or noise). The recognition decision rules should include two principles: (1) the change rate of two continuous data; and (2) the decreasing or increasing trend of the change rate, i.e., behavior of the approached curve. Finally, decide appropriate evolutionary algorithm to be hybridized in the analysis model, in addition, to avoid trapping in local optimum, adjustment approach could be employed with associated evolutionary algorithms into these hybrid models.

This discussion of the work by the author of this preface highlights work in an emerging area of evolutionary computation that has come to the forefront over the past decade. These articles in this text span a great deal more of cutting edge areas that are truly interdisciplinary in nature.

REFERENCES


Figure 4. The evolutionary algorithms support system (EASS)


