Editorial

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Mo M. Jamshidi (F-IEEE, F-ASME, F-AAAS, F-NYAS, F-TWAS) received the PhD degree in Electrical Engineering from the University of Illinois at Urbana-Champaign in 1971. He holds three honorary doctorate degrees and is Lutcher Brown Endowed Chaired Professor at the University of Texas System at San Antonio Campus, San Antonio, TX, USA. He is Founding Director of Center for Autonomous Control Engineering (ACE) at the University of New Mexico (UNM). He is also the Director of the National Consortium on System of Systems Engineering. He has over 550 technical publications including 58 books and edited volumes. He is the Founding Editor/Co-editor of five journals and one magazine.

This issue publishes mixed type of papers starting from a review type paper on mobile robotics to introduction of a high precision disc-type ultrasonic motor. Some papers deals with power systems and others are based on fault detection and nonlinear studies. The titles of the papers are follows.

1 Navigational strategies of the mobile robots: a review

2 Robust control of nonlinear systems using neural network based HJB solution

3 Unknown input nonlinear observer for component fault detection and isolation of dynamic systems

4 Artificial neural network based decision-making fault diagnosis in a normalised DC motor system

5 An adaptive stator resistance estimation technique for sensorless permanent magnet synchronous motor drive

6 A comparative study on different power system frequency estimation techniques

7 Particle swarm optimisation-based fuzzy satisfying method for economic environmental dispatch of hydrothermal power systems

8 Impact of LTC in power system nonlinear behaviour: algorithm and bifurcation analysis

9 Performance analysis of various Smith predictors for integrating processes with longer dead-time

10 Proof of stability and boundedness of a real-time motor resistance estimation and compensation scheme

The first paper discusses various navigation techniques and methods of mobile robot. The discussion is around the three main techniques and five methods. The review on fuzzy logic, ANN and GA technique are highlighted. In the second part of the paper, five important methods are discussed. The methods are potential field method, grid-type method, heuristic method, adaptive navigation method and virtual impedance method. The last part of the paper reviews the different types of sensors used.

Hamilton-Jacobi-Bellman (HJB) equation is very useful in developing optimal control algorithm for robust controller. The contribution of the second paper is around the optimal controller design that deals with designing feedback controllers for nonlinear uncertain systems. The framework is based on the optimality based robust control approach in which the robust nonlinear control problem is transformed into an optimal control problem by modifying a quadratic cost functional to account for a class of the matched uncertainties and uncertainties in the input matrix.

The unknown input observer has become a multi-purpose diagnostic tool in the field of fault detection and isolation. These types of observers also have wide applications in robust control. Over the years, researchers have developed different types of observers for both linear and nonlinear systems. In the next paper a new kind of unknown input observer for a class of nonlinear systems is proposed. The efficacy of the proposed scheme is tested in a mechanical system.

Industrial systems in the working environment suffer parameter deviation as time elapsed. Parameter variations do not make the system full proof and robust. In the fourth paper, authors proposed a new approach to fault diagnosis. The novelty of the work was that the authors did not make many assumptions as usually done in the conventional approach. They applied neural network structure as the implementation was considered to be less expensive. The methodology can be satisfactorily applied to any dynamical systems, although a normalised DC motor system was chosen for the study.

Permanent magnet synchronous motors are the horse power of many industrial drive applications. In such motors, the estimation of resistance plays a major role in the design. A stator resistance estimation method for drive is presented in the subsequent paper.

The authors used MRAS for the estimation. In this case, the instantaneous active power is utilised in the reference model, whereas, steady state active power under flux orientation is considered for the adjustable model. Simulation results are presented.

As indicated earlier this issue includes research work related to power systems and control. The first paper in this respect deals with the estimation of frequency by various estimation techniques including Extended Least Square technique. The motivation came from the fact that for an improved power quality, fast and accurate estimation of supply frequency, voltage and its variation in real time is essential in a complex power system. The authors point is that since the choice of the covariance matrix is very crucial at the initial instant for Kalman Filter algorithm, improper choice of covariance matrix can lead to more computational time with more estimation error. It has been proved that the computational time in the case of ELS is less due to the simplicity of the algorithm and estimation error is also less.

The second paper in power systems deals with scheduling issues of hydrothermal systems. The optimal scheduling of such system is more complex than the thermal systems. This paper applies a particle swarm optimisation-based fuzzy satisfying method in order to determine optimal hourly schedule of power generation. The proposed method has been applied on a sample test system. Numerical results have been presented to demonstrate the performance and effectiveness of the proposed method.

The final paper on power systems presents work on the impact of Load Tap Changer (LTC) to nonlinear behaviour of the power system. The results indicate that LTC dynamics can significantly contribute to understanding the complex nature of voltage collapse. The authors have attempted to show explicit bifurcation-based analysis. A numerical algorithm, based on initial value problem, using local parameterisation continuation technique is proposed for bifurcation analysis. It is shown that in certain moderately loaded conditions, dead-band sizes do not have any significant effect on the dynamic performance while, in heavily loaded conditions, the type of LTC models greatly influence the incidences of limit cycles and voltage collapse. It is also shown that LTC can only be temporarily relied upon to stop or delay the dynamic instability mechanism.

Paper 9 reviews robustness issues. The authors have shown the advantage of modified Smith predictors. It has the advantage over the dead-time compensating controllers. The controller is very suited for processes with varying longer dead-times and can be tuned manually in the same way as a PID. Out of five parameters, only three, such as gain, integral time and the dead-time, are adjusted. Apparently, the idea is not new, but it was necessary to study the performance of dead-time compensators for processes with integrator and longer dead-times.

DC motors are the most commonly used actuators in mechatronic systems. Motor parameters such as coil resistance, inductance and torque constant directly influence inaccuracies in the control scheme. The tenth paper is on parameter estimation scheme for brushless DC motor. Stability and boundedness of the scheme is mathematically proved using basic theorems from nonlinear system dynamics. The proof presented does not assume discretised plant equations.

A non-dynamic inverse model neglecting the electrical dynamics of the motor is used to achieve torque control of the motor. The scheme estimates resistance of the motor and compensate the change in real time via feedback control mechanism. The proof indicates the performance of feedback control can be improved by taking motor electrical dynamics into account in the motor inverse model and correcting for the back EMF compensation error in voltage control caused by the velocity sampling delay.