Mathematical Problems in Engineering

Special Issue on
Advanced Control Methods for Systems with Fast-Varying Disturbances and Applications

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In most real-world applications, disturbances, which affect stability and performance of the controlled system, are unavoidable. Not only do disturbances arise from external environments, but uncertainties such as modelling errors and parameter perturbations can also be considered as disturbances.

Unfortunately, disturbances are not measurable or are too expensive to measure. Thus, a simple solution to the control problem involving such disturbances is to estimate the disturbances by filtering (preprocessing) and to design an advanced control law based on this estimation. Although this approach has attracted much attention of numerous researchers in various fields of study, most estimation techniques rely on the assumption that the disturbance is slowly varying or constant. However, for fast-varying disturbances and systems with fast dynamics, these techniques may not be adequate to stabilize the system and achieve desired objectives such as tracking and regulation. Therefore, more advanced and recent techniques are needed to solve such problems.

Among some of the recent methods that have been developed are the disturbance observer based control and high-gain observer feedback methods. In addition, adaptive techniques with learning systems, including neurofuzzy networks, are especially effective in handling systems with unknown nonlinearities, modelling errors, and unknown disturbances/noises.

It is therefore the purpose of this special issue to bring together recent research results, reviews, and applications of some of the recent advanced techniques that focus on the design, analysis, and application of novel control schemes for dynamic systems subject to fast-varying disturbances.

Potential topics include but are not limited to the following:

- ▸ Fast-varying disturbance modelling and estimation techniques
- ▸ Fast-varying disturbance observer design
- ▸ Fast-varying disturbance observer-based control scheme design
- ▸ High-gain observer-based design methods
- ▸ Robust and adaptive control methods for systems with fast-varying disturbances and/or modelling errors
- ▸ Application of recent control schemes for disturbed systems such as electric motor drives, renewable energy conversion systems, robotic systems, and flexible structures
- ▸ Intelligent filtering methods
- ▸ Advanced methods for disturbance attenuation, faults detection, localization, and classification
- ▸ Applications of recent techniques of artificial intelligence and learning systems in control systems design with disturbances

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