Health Monitoring and Fault Diagnosis of Complex Systems ⋆

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Abstract: Due to the increasing demands on reliability, safety, maintenance as well as economic performance in operation of real physical systems, there is a rapid growth of research development on health monitoring and fault detection and isolation (FDI) with applications to modern complex systems including electrical systems, mechanical systems, structures. The primary objective of this Special Session is to provide up-to-date discussions on technical trends and advanced methodologies in health monitoring and fault diagnosis of such complex systems.

Keywords: Health monitoring; Fault diagnosis; Complex systems.

1. INTRODUCTION

Due to the increasing demands on reliability, safety, maintenance as well as economic performance in operation of real physical systems, there is a rapid growth of research development in both academia and industry on health monitoring and fault detection and isolation (FDI) with applications to modern complex systems including electrical systems, mechanical systems, structures. For instance, in the transport framework to ensure safe operation, it is crucial to introduce FTC/FDI algorithms. In another research front, health monitoring and fault diagnosis for low-speed rotary systems is of interest from both theoretical and practical perspectives, in particular for wind turbine systems. It still remains a challenging research area with large domain of applications such as automobile, transportation airplane, smart grid, wind farm. In such as complex systems, thanks to the well established model-based control and diagnosis techniques in the past two decades, numerous successful methods have been developed and applied in modern industrial processes. On the other hand, without prior knowledge about the underlying processes, the data-driven techniques have received considerable attention due to direct utilization of huge amount of available measurements with relative less design efforts for control and diagnosis purposes. The recent developments focused on related topics for modern complex systems thus become more important for both academic and industrial domains.

The primary objective of this Special Session is to provide up-to-date discussions on technical trends and advanced methodologies in health monitoring and fault diagnosis of complex systems. Of particular interest the papers in this special session are devoted to development of theoretical and practical aspects on new and emerging trends in FDI or fault tolerant control (FTC) with real applications, for instance, automobile, airplanes, wind turbine, wind farm, satellites. Solicited papers must bring new ideas and approaches, clearly indicating the advances made through problem statements, methodologies with applications to modern complex systems. Topics to be covered in this special issue include, but are not limited to the following:

- Robust control and filtering issues for complex systems;
- Optimization theory for controller and observer design;
- Recent developments on model based and data-driven techniques for FDI;
- Fault diagnosis, prognosis and health monitoring system design;
- Safety and health monitoring of complex systems;
- Big data solutions with complex system applications;
- Intelligence techniques, such as fuzzy logic, neural network approaches.
- Simulation technology for complex systems;
- Information constraints and sensor failures for complex systems;
- Soft computing methods for FDI/FTC of complex systems;
- Soft computing methods in instrumentation and signal processing of complex systems;
- Applications of FDI and FTC algorithms to advanced industrial applications.

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