Vibration Control of Complex Structural Systems ⋆

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Abstract: Vibration control, as one of important phenomenons in dynamical systems such as mechanical, electrical and hydraulic systems, has been widely studied in control theory and application. It mainly combines a vibrational control mechanism with advanced control algorithms to improve system performance and reduce the influence of vibrations. Especially, due to possible structural nonlinearities and uncertainties in complex structural systems, passive, active or semi-active vibration control techniques are still the challenging problems in the field of engineering control. In particular, this special session is devoted to papers which address the development of mathematical methodologies and mechatronic design issues for vibration analysis and control problems of complex structural systems, including non-linear dynamics, sensors and actuators selection and location, experimental results, for instance.

Keywords: Vibration control; Structural systems; Modeling; Simulation.

1. INTRODUCTION

Vibration is a phenomenon that affects systems such as bridges, buildings, electrical machines, vehicle suspensions, robot manipulators, and spacecraft. The protection of these systems against the harmful effects of vibration has become a major field of research in recent years. In the literature of vibration control of structural systems, different damping systems, mainly passive, active, semi-active and inerter damping systems, have been proposed and successfully applied to tackle the vibration problem. One critical characteristic common to most of these actuators is that they, in general, exhibit nonlinear dynamics and thus complex control techniques must be employed for an appropriate performance. Vibrations and possible component failures, which may quickly cause unacceptable system states, are perceived as the most important problems in mechanical system design.

Vibration control, as one of important phenomenons in dynamical systems such as mechanical, electrical and hydraulic systems, has been widely studied in control theory and application. It mainly combines a vibrational control mechanism with advanced control algorithms to improve system performance and reduce the influence of vibrations. Especially, due to possible structural nonlinearities and uncertainties in mechanical systems, passive, active or semi-active vibration control techniques are still the challenging problems in the field of engineering control.

The purpose of this special session is to provide an opportunity for scientists, engineers, and practitioners to propose their latest theoretical and technological achievements in vibration control. In particular, this special session is devoted to papers which address the development of mathematical methodologies and mechatronic design issues for vibration analysis and control problems of complex structural systems, including non-linear dynamics, sensors and actuators selection and location, fault diagnosis in mechanical systems, experimental results, for instance. Topics include, but are not limited to:

- Modelling, optimisation and identification of complex structural systems,
- Advanced controller design (robust control, adaptive control, backstepping control, sliding mode control, multi-objective control, quantitative feedback theory, soft computing methods, intelligent control, etc),
- Passive, active, semi-active vibration control design for complex structural systems,

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- Safety and health monitoring of complex structural systems,
- Wireless implementation, communication and structural information constraints for vibration control,
- Robust fault detection and isolation, fault diagnosis, fault-tolerant control of structural systems,
- Applications of vibration controllers to complex structural systems (including vehicles, precision motion systems, buildings, offshore structures, etc.),
- Smart sensors and actuators.