Preface

The demands of light-weight robotic systems and space applications have actuated the flexible structures. Numerous dynamic systems with flexible structures suffer from undesirable vibrations. Detrimental effects will cause serious problems for positioning accuracy, operating speed, effectiveness, and safety. Therefore, there is a need to study nonlinear dynamics and vibration control of flexible structures such that unwanted vibrations can be effectively reduced for safe and effective operations.

This book describes theoretical knowledge on nonlinear dynamics and vibration control. Then some industrial applications with flexible structures have been reported by using the theoretical knowledge. Those applications include bridge cranes, tower cranes, aerial cranes, dual cranes, flexible link manipulators, and liquid sloshing.

Theoretical knowledge of nonlinear dynamics includes dynamic modeling of nonlinear system, analyses of nonlinear oscillator, approximate solution of nonlinear oscillator, and modal analyses of multiple-mode system. Meanwhile, theoretical knowledge of vibration control includes linear control, nonlinear control, intelligent control, input shaper, and command smoother. Those control methods are effective and robust for attenuating vibrations.

Cable-suspension structures, light-weight links, and fluid motions in the container exhibit flexible-structure dynamics. Therefore, the dynamic modeling and dynamic analyses are very challenging for academic staff and graduate students. The vibration-reduction solutions are also provided by using the advanced control methods.

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