Preface

The past decades have seen increasing attention from the research community worldwide on structural health monitoring (SHM). The efforts have promoted the continued advancement of sensing as well as signal processing technologies. In addition to commonly used time and frequency domain techniques, advanced signal processing techniques, such as wavelet transform and sparse representation, have been investigated as new tools for health monitoring of various mechanical or structural systems. However, many challenges and problems remain unsolved as of now or not fully addressed for SHM when signal processing techniques are applied to dealing with data measured from the system. For example, the complication of mechanical or structural systems results in complexity of the monitoring signals. Also, background noises weaken the effective condition signal and thus hinder the interpretation of the condition information. Furthermore, the specialization of each monitoring object leads to the predicament that a single signal processing technique cannot be effective for any SHM demands, which is also the reason why there are many advanced signal processing methods to be researched by academy and industry.

The book aims at introducing some advanced signal processing techniques that can be used in the field of structural health monitoring. The book contains invited chapters from researchers, who are experts in applying signal processing technique to solve structural health monitoring problems. It starts with an introduction on basic knowledge of structural health monitoring, followed by traditional frequency domain analysis, which is discussed for crack detection and rotor balance correction. Then some newly developed signal processing techniques, including wavelet transform, time-frequency analysis, compressive sensing and sparse representation, empirical mode decomposition, local mean decomposition and stochastic resonance, are introduced in theory with applications to various mechanical and structural systems. These advanced signal processing techniques are believed to be beneficial to structural health monitoring.

We would like to thank all the authors for their contribution and sharing of their knowledge. We do sincerely hope that the readers will find this book interesting and useful in their research on advanced signal processing for structural health monitoring.

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