Smart structures and materials 2002.

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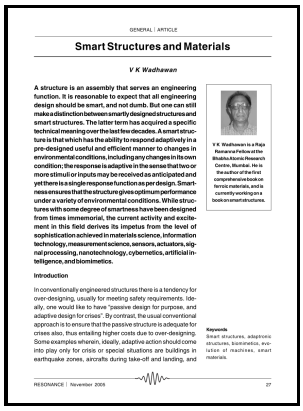
GENERAL | ARTICLE

Smart Structures and Materials

V K Wadhawan

A structure is an assembly that serves an engineering function. It is reasonable to expect that all engineering design should be smart, and not dumb. But one can still make a distinction between smartly designed structures and smart structures. The latter term has acquired a specific technical meaning over the last few decades. A smart structure is that which has the ability to respond adaptively in a pre-designed useful and efficient manner to changes in environmental conditions, including any changes in its own condition; the response is adaptive in the sense that two or more stimuli or inputs may be received as anticipated and yet there is a single response function as per design. Smartness ensures that the structure gives optimum performance under a variety of environmental conditions. While structures with some degree of smartness have been designed from times immemorial, the current activity and excitement in this field derives its impetus from the level of sophistication achieved in materials science, information technology, measurement science, sensors, actuators, signal processing, nanotechnology, cybernetics, artificial intelligence, and biomimetics.

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Introduction

In conventionally engineered structures there is a tendency for over-designing, usually for meeting safety requirements. Ideally, one would like to have "passive design for purpose, and adaptive design for crises". By contrast, the usual conventional approach is to ensure that the passive structure is adequate for crises also, thus entailing higher costs due to over-designing. Some examples wherein, ideally, adaptive action should come into play only for crisis or special situations are buildings in earthquake zones, aircrafts during take-off and landing, and

Keywords
Smart structures, adaptronic structures, biomimetics, evolution of machines, smart materials.

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The optimization problem was formulated as a variable thickness sheet problem where the stiffness was maximized subject to a constraint on the free stoke. Conventional methods in health monitoring mainly focus on differences in the modal parameters such as natural frequency, but they require the existence of a large damage in order to detect the damage efficiently. The control scheme takes advantage of two adaptive feed forward controllers and an adaptive feedback controller.

Introduction

Its chemical composition and thermal behavior were determined using Fourier-transform infrared and thermal gravimetric analysis, respectively. As a result it is shown, that the Duffing type nonlinearities found in measurements can be described with this model.

Smart Structures and Materials 2002: Smart Structures and Integrated Systems

Before embedment, a length of the optical fibre was micro-braided using glass fibres to compare in situ strains monitored by the micro-braided and 'bare' fibre segments. The signal Short Time Fourier Transform STFT has been computed and several robust noise reduction algorithms, such as Wiener adaptive filtering, improved spectral subtraction filtering, and Singular Value Decomposition SVD -based filtering, have been applied. Aiming to diminish the effect of temperature on the piezoresistive property of SSCC, the SSCC responses to simultaneous temperature and loading excitations are then treated using a Bayesian blind source separation BSS method to reconstruct two independent sources.

Dynamic smart material and structural systems

Since the microstructure is defined parametrically, the density of each material can be controlled independently at each point. Various healing agents have been explored in the literature for their efficacy to recover mechanical and durability properties in cementitious materials.

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The configurational forces concept combined with the thermo-electro-mechanical extension of the J-integral are used to analyze the impact of the different factors on the crack driving energy. In this design the horn elements are folded which reduce the overall length of the resonator physical

length but maintain or increase the acoustic length.

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