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Civil Structures Sustainability through Smart Material Application

Alireza Małgorzata

Center of Research and Development, Kuala Lumpur 52200, Malaysia

Editorial

Because of the limitations of design methods and materials to survive strong earthquakes, structural defects or breakdowns kill thousands of people each year and cost billions of dollars. There is a conflict between these limits and the growing need for more sustainable constructions since earthquakes have a substantial impact on sustainability aspects. A substantial effort has been made to overcome these limits by developing various techniques and materials. The use of smart structures and materials, such as shape memory and piezoelectric materials, is one of these potential options.

Every year, earthquakes, as one of the most severe conditions that expose structures, kill thousands of people and wreak billions of dollars in property damage around the world. Assessing the seismic risk of building stock in earthquake-prone areas with dense populations and urbanisation is a challenge for governments and researchers. The natural hazards approach is critical for building disaster response systems and ensuring catastrophe risk and response management in the context of long-term development.

Until now, many academics have looked into the utilisation of these materials and their structural properties, However, the link between environmental concerns and the use of smart materials has gotten little attention. As a result, this work seeks to draw a more substantial relationship between smart materials and structural sustainability by reviewing prior experimental, numerical, and conceptual investigations.

First, the enormous impact of seismic occurrences on structural sustainability is highlighted, along with its primary elements. After that, there's a rundown of the principles of smart material behaviour and attributes. Finally, the impact of smart materials deployment on sustainability issues is examined following a thorough examination of the most current applications of smart materials in structures. By creating a more clear relationship between these two notions, the findings of this study are intended to assist researchers in correctly addressing sustainability factors in any research and deployment of smart materials.

A structure's sustainability can be determined by how well it responds to three key aspects of suitability: economic, social, and environmental consequences. To put it another way, it must be ecologically friendly and resource efficient throughout its whole life cycle. When traditional materials like steel and concrete, as well as design processes in civil constructions, are subjected to strong seismic stresses, they show signs of fragility. It can result in structures being destroyed or collapsing, resulting in exorbitant repair expenses, fatalities, environmental contamination, and so on.

This is why it is vital to improve the performance of structures by increasing their adaptability and flexibility during a seismic event. It will lead to more appropriate constructions that can survive earthquakes while reducing deflections, additional repairs, and casualties. LCA analyses are becoming increasingly standard procedures in building, and they result in waste and energy reduction. Additional research is required, and the authors intend to construct and examine a variety of case studies, particularly for the use of low-cost smart materials, which lowers project costs.

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***Address for Correspondence:** Alireza Małgorzata, Center of Research and Development, Kuala Lumpur 52200, Malaysia, E-mail: Alirezamałgorzata@gmail.com*

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