Chapter 7
Integrating Sustainability Into Earthquake Resilience:
Practical Applications of the Euler–Lagrange Methodology in Building Behavior Analysis

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ABSTRACT

The study of earthquakes and their impact on buildings from the practical application of Physics in Architecture is essential to ensure the safety of building occupants in seismic zones. Models made with spaghetti and tested on a shaking table allow architects and engineers to experiment with different designs and materials to determine the best way to resist the vibrations produced by earthquakes. Teaching innovation and education play a fundamental role in the study of earthquakes and their impact on buildings through the practical application of Physics in Architecture. To ensure the safety of occupants in seismic zones, it is necessary to have well-trained

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and up- to-date professionals in the latest techniques and knowledge related to earthquake-resistant design.

1.- INTRODUCTION

Earthquakes are one of the most destructive natural phenomena in existence. Throughout history, they have caused the loss of human lives and incalculable material damage all over the world. That is why understanding how earthquakes form and how they affect buildings has become a priority for experts in physics and architecture.

As the British physicist and writer Stephen Hawking said: “Physics is like philosophy: it tries to understand the world, but with more precise tools”. Physics therefore becomes a fundamental tool for understanding seismic phenomena and their implications for the construction of resistant buildings.

To carry out a complete study of earthquakes and their impact on buildings from the practical application of physics in architecture, it is necessary to analyse how earthquakes are formed and how they affect buildings. In addition, a shaking table and spaghetti models can be used to better understand the phenomena of vibration, small-amplitude harmonic motion and the Euler- Lagrange equation.

As the Italian architect and designer Renzo Piano said: “Architecture is an instrument of change, an instrument to improve people's lives”. In this sense, the practical application of physics in architecture can contribute to improving the seismic resistance of buildings and thus to improving people's lives.

In the field of education, teaching innovation focuses on finding effective methods to teach the fundamental concepts of earthquake physics and its relationship with architecture. Educators are seeking creative and practical ways to transmit knowledge, using tools such as computer simulations, physical models, and interactive exercises.

The use of advanced technologies, such as virtual and augmented reality, allows students to experience the effects of earthquakes in an immersive way and explore different earthquake- resistant design scenarios. These technologies also facilitate the visualization of complex and abstract phenomena, enhancing understanding of theoretical concepts.

Furthermore, interdisciplinary collaboration between architects, structural engineers, and seismologists is essential in the education of students. Promoting teamwork projects where students can apply their knowledge in a practical setting fosters active learning and real- world problem-solving.