



## STRUCTURAL APPLICATIONS OF SHAPE MEMORY ALLOYS FOR SEISMIC RESILIENCE ENHANCEMENT

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### ABSTRACT

Shape Memory Alloys (SMAs) are materials with advanced properties having the ability to recover their initial geometry by unloading which indicates the superelastic effect through the phase change (austenitic-martensitic). The discovery of their special nature was made in the 1960s. It was noticed that apart from their good mechanical properties they possessed a shape recovery capability, a characteristic that since then has made SMAs popular in a wide range of industrial fields, such as aerospace, automotive, dental and biomedical sector <sup>[1]</sup>. Some other aspects, such as the damping change in relation to temperature, the composition of the alloy, the temperature and the mode of plastic deformation, began at that time to attract the interest of researchers.

As far as engineering applications are concerned, research studies of implementations of the SMAs accounting for the exploitation of their superelastic effect particularly have increased in recent years. Researchers have investigated their use as damping devices, as bracing systems and in beam-column connections, incorporated in base isolation devices. In the present paper an in-depth look is attempted to familiarize with SMAs as innovative metallic materials to be employed in structural engineering applications while particular emphasis is shown to their deployment towards improving buildings' seismic resilience <sup>[2]</sup>. In this framework, recent advances in scientific research are summarized and thoroughly presented aiming to provide an up-to-date scientific, highlighting thus also the SMA potential in construction sector.

### References

- [1] Buehler, W.J., Gilfrich, J.V., Wiley, R.C., “*Effect of Low-Temperature Phase Changes on the Mechanical Properties of Alloys near Composition TiNi*”, Journal of Applied Physics, Vol. 34, No 5, pp.1475-1477, 1963. <https://doi.org/10.1063/1.1729603>
- [2] Cardone, D., Angiuli, R., Gesualdi, G., “*Application of Shape Memory Alloys in Historical Constructions*”, International Journal of Architectural Heritage, Vol. 13, No. 3, pp. 390-401, 2019. <https://doi.org/10.1080/15583058.2018.1563225>