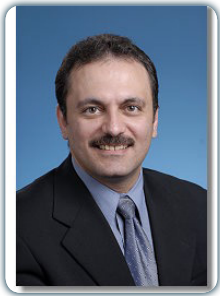


5th World Congress on

SMART AND EMERGING MATERIALS

April 19-20, 2018 Dubai, UAE



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Strengthening/reinforcing concrete structures using shape memory alloy

Shape memory alloy (SMA) has been attracting the researchers from different fields due to their superior properties. The SMA is a unique class of alloy with the ability to undergo large deformation as well as energy dissipation capacities while maintaining a super-elastic response and return to its original shape through stress removal (super elasticity) or heating (shape memory effect). SMA as internal reinforcement: The superior properties of SMA make it a good reinforcement candidate for the use in the seismic design of structures. The exceptional property of SMA in recovering substantial inelastic deformation upon unloading makes it very beneficial in seismic design. Thus, if SMA is used at the location of plastic hinges with proper design limitations, the structure will dissipate the demand energy and return to its original shape when unloaded. The design of self-centering concrete beam-column connections reinforced using SMA is an innovative proposal and can be optimized for the use in real-life construction. SMA in strengthening applications: Besides the material super-elasticity, corrosion and fatigue resistivity, SMA is mainly characterized by the shape memory effect that represents the ability of the SMA to recover its original shape after being deformed beyond the elastic limits through heating. The strain recovered in this transformation process can be utilized for pre-stressing applications by eliminating the use of hydraulic jacks. By having the pre-strained SMA reinforcement attached to the RC members and then applying heat above the activation temperature the SMA will recover the inelastic strain and thus a pre-stressing force will be developed in the RC member. The pre-strained SMA itself can be used as the pre-stressed reinforcement in flexural strengthening of RC beams as well as active confinement of RC columns.

Recent Publications and References

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3. Rojob, H., and El-Hacha, R., "New Anchorage Mechanism for Smooth Fe-SMA Bar used for Flexural Strengthening of RC Beams using NSM Technique," *Proceedings of the 4th International Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures (SMAR 2017)*, Switzerland, Zurich, 13-15 September 2017, (CD-Rom-8p.)
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6. Oudah, F., and El-Hacha, R., "Innovative Self-Centering Concrete Beam-Column Connections using Shape Memory Alloy." *Proceedings of the 3rd International Conference on Smart Monitoring, Assessment and Rehabilitation of Civil Structures (SMAR 2015)*, Antalya, Turkey, 7-9 September 2015, (CD-Rom-8p.)
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Biography

Raafat El-Hacha is then Professor of Structural Engineering at the University of Calgary in the Department of Civil Engineering. He is the member of the International Institute for FRP in Construction (IIFC), American Concrete Institute (ACI), Canadian Society of Civil Engineers (CSCE) and Pre-stressed Concrete Institute (PCI). He is a Fellow member of the IIFC and the CSCE. He is the co-chair of Sub-Committee ACI 440-I "FRP Prestressed Concrete", and chair of the CSCE Committee on "Advanced Composite Materials for Bridges and Structures". Dr. El-Hacha research interest focuses on using high performance advanced materials, such as FRPs, Shape Memory Alloy, Ultra-High Performance Concrete, for hybrid structural systems in bridge applications and other structures. He published over 220 journal and conference papers, co-authored 3 refereed design guidelines. Supervised and graduated 41 students. Served as guest editor for 3 journals, and edited/co-edited 8 conference proceedings. He is the recipient of several distinguished awards and fellowships including the IIFC President's Award–2016, the CSCE Casimir Gzowski Gold Medal–2014, the Erasmus Mundus International Fellowship–2014 and 2013, the CSCE Excellence in Innovation in Civil Engineering Award–2011, and many others for his outstanding academic and professional experiences and achievements.

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