The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

# A COMPUTATIONAL STUDY OF THE PRESTRESS STATE CAUSED BY ACTIVATED SHAPE MEMORY FIBERS IN ULTRA HIGH PERFORMANCE CONCRETE

**Stefan Descher[1], Sebastian Wolf[1], Alexander Wetzel[2], Philipp Krooß[3] and Detlef Kuhl[1]**

[1] Institute of Structural Mechanics, University of Kassel, Mönchebergstraße 7, 34125 Kassel, Germany, kuhl@uni-kassel.de

[2] Institute for Structural Materials and Construction Chemistry, University of Kassel, Mönchebergstr. 7, 34125 Kassel, Germany, alexander.wetzel@uni-kassel.de

[3] Institute of Materials Engineering, Metallic Materials, University of Kassel, Mönchebergstr. 3, 34125 Kassel, Germany, krooss@uni-kassel.de

**Keywords**: *shape memory alloy, ultra high performance concrete, prestressing*

In order to enrich ductility of ultra high performance concrete constructional elements significantly, steel fibers are usually embedded in the cementitious matrix [1, 2]. The present study is dealing with the perspective substitution of steel fiber reinforcements by pre-stretched shape memory alloy fibers [3, 4]. In particular, the prestress states in the ultra high performance concrete matrix and the shape memory fibers caused by the heat introduced shape memory transformation strain is investigated. Therefore, the mechanical behavior of single fiber and multiple fibers concrete test specimens with different fiber arrangements is simulated by the finite element method [5] and analyzed with special attention to the prestress state in the cementitious matrix material.

## REFERENCES

[1] E. Fehling, M. Schmidt, J. Walraven, T. Leutbecher and S. Fröhlich., *Ultra-High Performance Concrete UHPC: Fundamentals, Design, Examples*. Wiley-VCH, 2014.

[2] T. Gleim, D. Kuhl, M. Schleiting, A. Wetzel and B. Middendorf, High-Order Numerical Methods for the Thermal Activation of SMA Fibers. *Proceedings in Applied Mathematics and Mechanics*, Vol. **19**, DOI: 10.1002/pamm.201900025, 2019.

[3] D.C. Lagoudas, *Shape Memory Alloy. Modeling and Engineering Applications*. Springer, 2008.

[4] D.I. Arun, P. Chakravarthy, R. Arockia Kumar and B Santosh, *Shape Memory Materials*. CRC Press, 2018.

[5] O.C. Zienkiewicz, R.L. Taylor and D.D. Fox, *The Finite Element Method for Solid & Structural Mechanics*. 7th Edition, Elsevier, 2014.