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ISOGEOMETRIC REPRESENTATIONS FOR DIGITAL TWINS SUBJECTED TO DYNAMIC EXCITATIONS WITH GEOMISO DNL SOFTWARE

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This paper introduces the Geomiso DNL software for digital twins of inelastic structures subjected to dynamic loads. This new hybrid program (www.geomiso.cloud) provides 3D design and isogeometric analysis with NURBS and T-splines. Taking advantage of the new horizons offered in the peak of the Industry 4.0 era, the physical twin feeds, via cloud technology, with real-time data its geometrically exact digital twin, while a dynamic analysis is performed and crucial results about structure safety and quality are obtained.

Geomiso DNL is not just a plug-in, but a both on-premises and cloud-based software, which satisfies the rising industrial need for unification of the fields of computer-aided design and computer-aided analysis and enables engineers to simulate complex dynamic phenomena, whose impact on industrial products and structures in real-world environments can be more efficiently estimated. The adopted isogeometric method maximizes the efficiency of this feedback loop between the physical and the digital twins since the CAD model can be directly used for structural analysis. This new software with its modern graphical user interface fully integrates the industrial design of any geometry with its computational real-time testing by facilitating the geometry modeling within analysis, as it provides analysis suitable parameterized geometries and weaves the mesh generation process within CAD, thus it offers a novel way to create digital twins without introducing geometric errors, while capturing the exact real time response due to its locally refined basis.

Typical applications arisen in structural dynamics are demonstrated, combining material inelasticity with 2D and 3D dynamic problems and compared to FEA packages. This software leads to higher accuracy of the numerical results, robustness, and stability level, combined with significantly shortened computational cost. Geomiso DNL appears to be preferable to FEA software packages as a promising solution not only for enhancing quality control in the design and production process, but also during product's whole lifetime. This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call «RESEARCH–CREATE–INNOVATE» (project code: T2EDK-00338).

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