Modeling and Analysis of Real World and Industry Applications with Geomiso ISA: A New Hybrid CAD/CAE Software for Static Isogeometric Analysis with Plate Elements and Advanced Spline Techniques

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In this paper, we propose Geomiso ISA (www.geomiso.com), a new software for applications on static isogeometric analysis with plate elements and advanced spline techniques. It is based on the isogeometric method, the powerful generalization of the traditional finite element method, which, in combination with the plate theory, has attracted increasing attention in construction industry over the last decade, as it achieves efficient design-through-analysis procedures and shows superior performance. Although NURBS are ubiquitous in CAD industry, the most promising spline technology is T-splines, which overcome limitations inherent to NURBS, ensure higher-order continuity across patches and permit local refinement.

The recently developed Geomiso ISA program is not just a plug-in, but a both on-premises and cloud-based software solution, applicable to real world and industry applications, which provides static isogeometric analysis with plate elements. It is used to simulate spline models of slabs and analyze their strength and behavior, while it has many features in common with both FEA software and design programs. This solution addresses the rising industrial need for seamless integration of computer-aided design and computer-aided analysis, while it appears to be more efficient to FEA software packages, as it facilitates the geometry modeling within analysis, eliminates geometric errors and achieves superior accuracy per degree-of-freedom with shortened computational cost. It offers an innovative way to merge geometric design with mesh generation into a single procedure by designing, with its modern user interface, slabs as tensor product grids in contrast to design programs.

Real world and industry applications on thin (Kirchhoff-Love) and thick (Mindlin-Reissner) plates are demonstrated with a comparison between Geomiso ISA and FEA programs, and between plate and hexahedral elements. We compare the accuracy of the numerical results, such as displacement, strain and stress fields, and the stiffness matrix assembly and solver time for analysis of typical slab types widely used in construction. We carry out parametric investigations on the effects of polynomial order, multiplicity and continuity of basis and shape functions, as well as on the number of control points and knot spans. This hybrid software represents improvements over finite element software packages, as higher accuracy, robustness, and stability level are accomplished.

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