An Isogeometric Design-through-Analysis Tool for Engineering Applications

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An Isogeometric Design-through-Analysis Tool for Engineering Applications

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Project Description:
When you're a design engineer creating the next car, airplane, or building, you need to use 3D models of parts to know: 1) if they'll fit together appropriately and 2) whether the parts can withstand the wear and tear of normal operation. Nowadays, CAD (Computer Aided Design) models are typically used for #1, and simulation and analysis tools like Finite Element Analysis (FEA) are typically used for #2. Despite dealing with the same design objects, CAD and analysis models use entirely different geometrical constructs. It is necessary to convert CAD models to mesh representations to be suitable for simulation and analysis. This is a significant bottleneck to the effective use of simulation and analysis in engineering design. Isogeometric analysis (IGA) is a recently developed computational approach to bridge this gap. The core idea of IGA is to use the same basis functions for the representation of geometry in CAD and the approximation of solution fields in simulation and analysis. This approach bypasses the cost-intensive mesh generation process required for simulation and analysis, which will significantly improve the efficiency of complex engineering design. The aim of this project will be to develop an isogeometric design-through-analysis tool to help design engineers more effectively use simulation to improve product performance. We plan to develop a Rhino plug-in with a user-friendly interface to take cross-sectional geometries of engineering applications, generate an appropriate surface model, and perform structural analysis, all within the CAD software.