

An Immersive Topology Environment for Generalized Hex and Tet Meshing of CAD Models

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Intermittent users of mesh generation technology often require significant time and overhead to build a mesh suitable for simulation. For a given CAD model, the user may be required to perform a number of complex decisions and operations to successfully prepare the model for analysis. Although current software tools may provide the needed capabilities, without a thorough understanding of their use and limitations, this process can become frustrating and time consuming, requiring a major investment of time to become proficient. The Immersive Topology Environment for Meshing (ITEM) is a wizard-like environment, built on top of the CUBIT Geometry and Meshing Toolkit, intended to help guide the intermittent user through the process of preparing a CAD model for simulation. ITEM is focused on three main objectives: 1) guiding the user through the simulation model preparation workflow; 2) providing the user with intelligent options based upon the current state of the model; and 3) where appropriate, automating as much of the process as possible. To accomplish this, a *diagnostic+solution* approach is taken. Based upon diagnostics of the current state of the model, specific solutions for a variety of common tasks are provided to the user. Some of these tasks include geometry simplification, small feature suppression, resolution of misaligned assembly parts, decomposition for hex meshing, and source and target selection for sweeping. The user may scroll through a list of intelligent solutions for a specific diagnostic and entity, view a graphical preview of each solution and quickly perform the solution to resolve the problem. In many cases, automatic solutions for these tasks can be generated and executed if the user chooses. This talk will discuss the various diagnostics and geometric reasoning algorithms and approaches taken by ITEM to determine solutions for preparing an analysis model. Several real-world examples will be used to demonstrate the effectiveness of the environment.

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