

Simulation Modeling Sciences

CUBIT Fast-Start Tutorial 8. The Immersive Topology Environment for Meshing (ITEM)



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CAD to Mesh

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The CAD to mesh process can be a complex series of iterative steps requiring in-depth understanding of the model and its flaws, expertise in using the software, and creativity to infer and apply solutions.



ITEM Overview

- Immersive Topology Environment for Meshing
- Designed to help the new or intermittent Cubit user
 - Guide the user through the simulation model preparation workflow
 - Provide the user with intelligent options based upon the current state of the model
 - Where appropriate, automate as much of the process as possible
- To accomplish this, a '*diagnostic* + *solution*' approach is taken.





Summary of Problems/Diagnostics

Problem	Diagnostic	Solutions
Small Curves	Curve length < ε	 composite surfaces collapse curve remove topology
Small Surfaces	Surface area $< \varepsilon^2$	1. regularize
Narrow Surfaces	$d_i < \epsilon$ for all curves on surface	 remove/extend surfaces composite surfaces remove topology
Surfaces with Narrow Regions	$d_i < \epsilon$ for some curves on surface	1. split off narrow region and treat as narrow surface
Misaligned volumes	Near coincident vertex or misalignment check	 tweak surf A to surf B tweak surf B to surf A
Unmerged surfaces	Overlapping surfaces check	 force merge imprint vertices imprint curves
Non-sweepable/mapable topology	Autoscheme tool	1. cut locations based upon dihedral angles and connectivity graph
Nearly sweepable	Autoscheme tool + sweep suggestions	1. suggested source/target pairs
Linking surfaces not mapable	Linking surfaces: 1.Curve length < ε 2.Interior angles deviate significantly from 90°	1. composite surfaces
Poor mesh quality	Quality metric < threshold	Mean Ratio or Smart Laplacian smoothing applied to 1.entire mesh 2.element quality group 3.individual elements



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8 × Power Tools 9 Task Description Tasks Create your finite element mesh by clicking on the links below. Clicking a link displays tools and instructions Import or Create for completing that step. Geometry Import or create geometry Ť Setup the FEA model Setup FEA Model Prepare geometry 9 Mesh the geometry Prepare Validate the mesh Geometry Define boundary conditions HI. Export the mesh Mesh 9 Validate Mesh <u>م</u> Define How to Use the ITEM Wizard BC's Guide to Meshing in ITEM Export Mesh

Interface is presented in the recommended order of operation. - Define geometry - Establish parameters

- Prepare geometry
- -Mesh
- Validate
- -Setup BCs
- Export



This menu allows the user to skip from section to section in ITEM if necessary.



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The Prepare Geometry page will help identify problem areas in the geometry.

Icons indicate potential problems yet to be resolved. Click on link for help in resolving

Important: May need to rerun diagnostics several times during geometry preparation

🍿 Cubit 15.4b X File Edit View Display Tools Help D 🔁 🗄 V I' 🕸 🕸 🛈 🖉 💶 🗢 🗇 🗇 🎯 🎯 🗊 🛃 🔩 🖬 🗢 💉 🕱 🎄 🖪 🕤 🐚 () Power Tools ₽ × X 詚 Prepare Geometry Tasks Prepare Geometry Follow the steps below to help Import or prepare your geometry for Create meshing. Geometry 畲 Run Checked Diagnostics Setup FEA Fix invalid topology Model Remove small features 2 \checkmark Prepare Geometry Connect volumes Mesh d meshable 9 Validate Set element sizes Mesh ____ Define Completing one geometry preparation phase can sometimes introduce problems in another. You BC's may need to revisit steps to make sure all problems are resolved completely. Export Command Line WARNING: Volume 1 (Volume 1) must have its meshing scheme explicitly specified it is not automatically mappable, submappable or sweepable. WARNING: Volume 2 (Volume 2) must have its meshing scheme explicitly specified: it is not automatically mappable, submappable or sweepable. Cubit>set overlap max gap 0.0005 Journaled Command: set overlap maximum gap 0.0005 Cubit> Command / Error / History Model Tree Power Tools Working Directory: C:/Users/Randy/Desktop/tutorial-images

CUBIT Basic Tutorial











User may choose to change the small curve length threshold.

Changing the small curve size will change the number of entities that are detected



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ITEM Exercise

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Use ITEM to mesh item-example.sat





