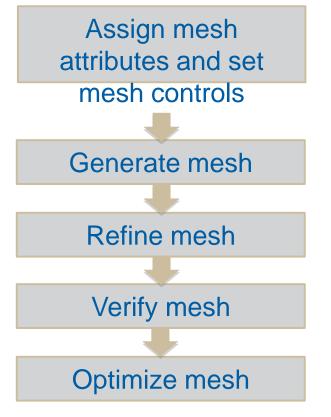
İİ ABAQUS ME 498CM Fail 2016

Meshing

Computational Science and Engineering

Meshing Workflow



OBJECTIVE—balance results accuracy against rate of convergence

CREATION—seeding, element type, remeshing techniques

VERIFICATION—element quality, shape factor, aspect ratio, element degeneracy

REMESHING/REFINEMENT—based on results of analysis incl. large deformations or gradients



Dependent v. Independent

Dependent

Instance is a pointer to the meshed original part

Independent

An independent part instance is a copy of the geometry of the original part

	Module: Mesh	~	Model: Model-1	~	Object: Assembly Part
t bar change the Object	t				

In the context bar, change the Object
 In the model tree, right click the instance

name

How to Switch





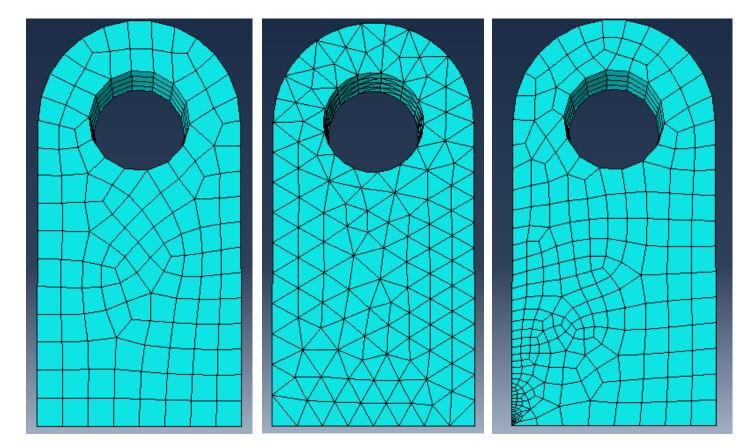
No customization allowed:

cannot modify geometry,

partition, virtual topology

Mesh Attributes

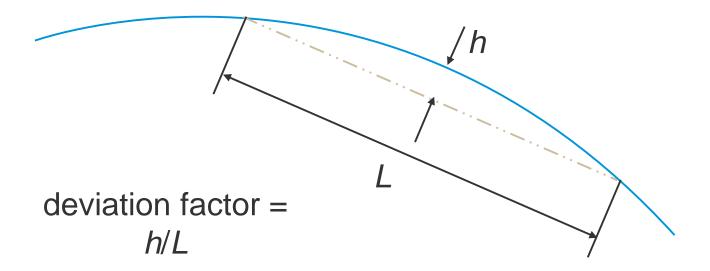
- Element shape control
- Seed assignment and bias



ABAQUS Meshing Mesh Attributes: Curvature Control

Seed distribution based on edge curvature and target element size

Accounts for deviation factor and minimum size factor





Meshing techniques

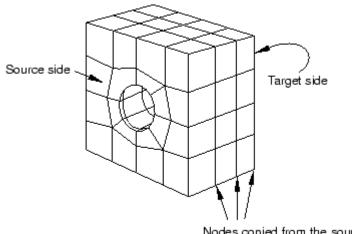
Top-down meshing

- **Structured** meshing
- Swept meshing (sourcetarget along path)
- **Free** meshing
- Unmeshable part
 Bottom-up meshing

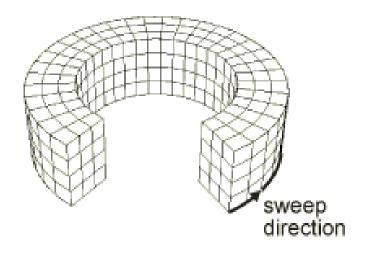
💠 Mesh Controls	x
 Element Shape ● Hex ○ Hex-dominated ○ Tet ○ Wedge 	
Technique Note: Press Defaults to replace the bottom-up technique with the default top-down techniques. As is Structured Sweep Sweep One Multiple	
Assign Stack Direction	
OK Defaults Cancel	



ABAQUS Meshing Swept Mesh

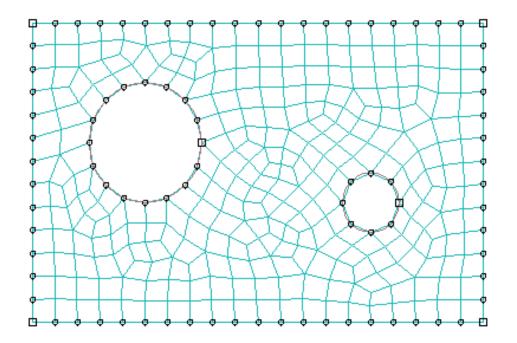


Nodes copied from the source side to each element layer and to the target side.



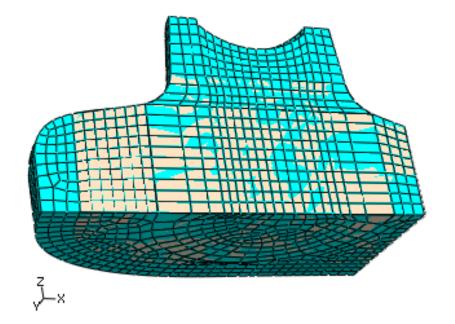


Free Meshing



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Bottom-Up Meshing



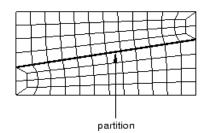
Example 17.11.10

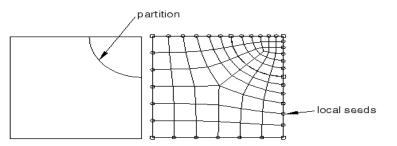
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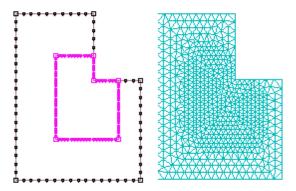
CSE.ILLINOIS.EDU

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ABAQUS Meshing Refinement by Partitioning (structured)

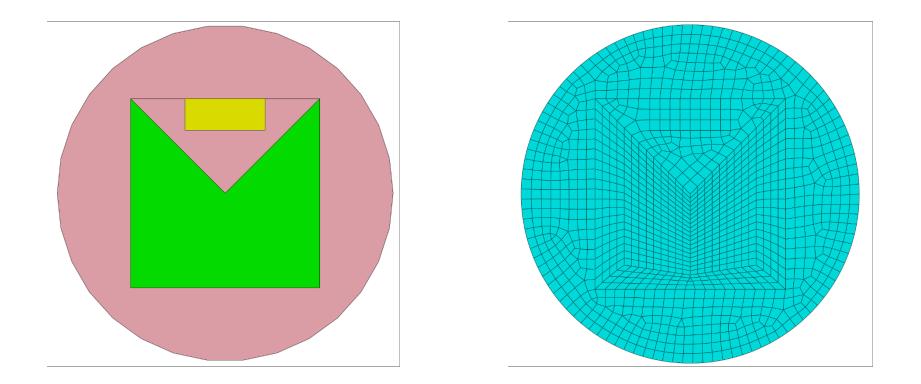






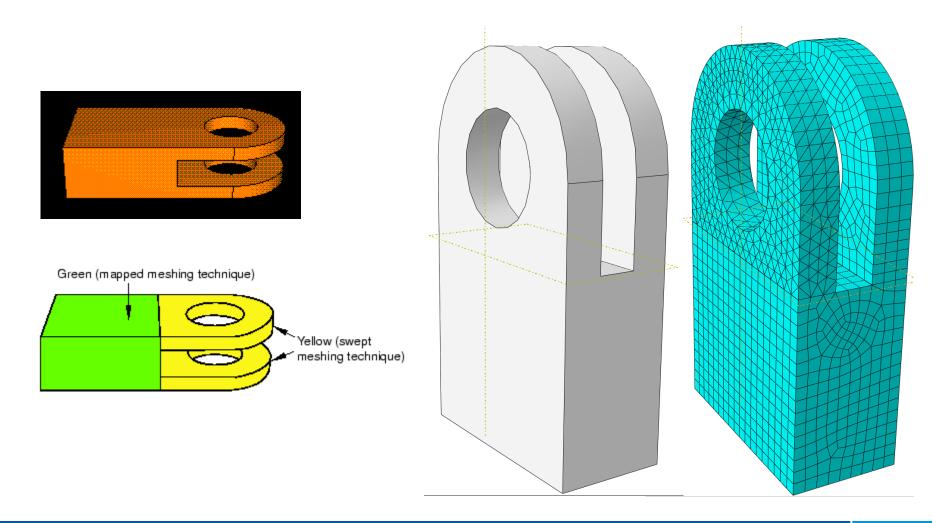


Refinement by Partitioning



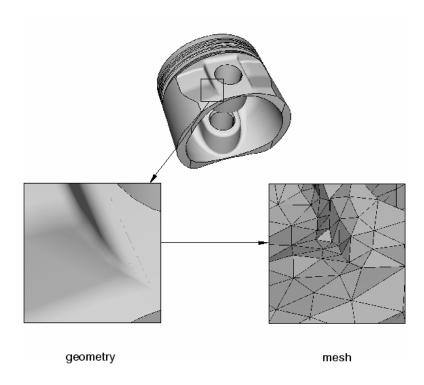


Refinement by Partition



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Refinement by virtual topology



Create Virtual Topology	×
Candidate Entities to Merge	
Edges shorter than: 0.18	🚞 🔶 🛛
Faces smaller than: 0.16	🚞 🅎 📗
Faces with aspect ratio larger than: 10	🚞 🅎
\checkmark Faces with corner angle smaller than: 10	🚞 🔶
✓ Faces representing stair features thinner than: 0.036	🚞 🙆
Redundant edges and vertices:	(
Curvature Controls for Combined Entities	
Angular tolerance for sharp edges/vertices (deviation from 18	0 degrees):
• Use defaults (30 degrees) C Specify:	🚞 🕎
Note: Sharp edges/vertices will be retained, except for sta	ir features.
☑ Keep blends if the following two conditions are met:	
Subtended angle larger than: 60	🚞 🔗 📄
Radius smaller than: 0.9	🚞 🤗 📄
Тір	
Create Preview Defaults	Dismiss



Verify M	lesn		
Shape Metrics	Size Metrics	Analysis Checks	
Elemen	t Failure Ci	riteria	
🔽 Geo	metric dev	iation factor greater tha	n: 0.1
🔲 Edg	e shorter th	han:	0.01
🔲 Edg	e longer th	an:	1
📃 Stab	le time inc	rement less than:	0.0001
		wable frequency lements) less than:	100
Create	set PoorE	lements-1 containin	g elements 💌
Highligh	t Res	select Defaults	Dismiss

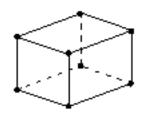
Mesh Verification

Aspect Ratio: Ratio between longest and shortest edge of a element.

Shape Factor: triangular and tetrahedral elements

Selection criterion	Quadrilateral	Triangle	Hexahedra	Tetrahedra	Wedge
Shape factor	N/A	0.01	N/A	0.0001	N/A
Smaller face corner angle	10	5	10	5	10
Larger face corner angle	160	170	160	170	160
Aspect ratio	10	10	10	10	10

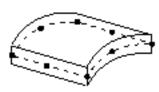
Element Library



Continuum (solid) elements



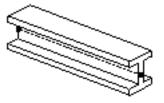
Membrane elements



Shell elements



elements

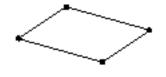


Beam elements

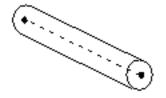
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Springs and dashpots



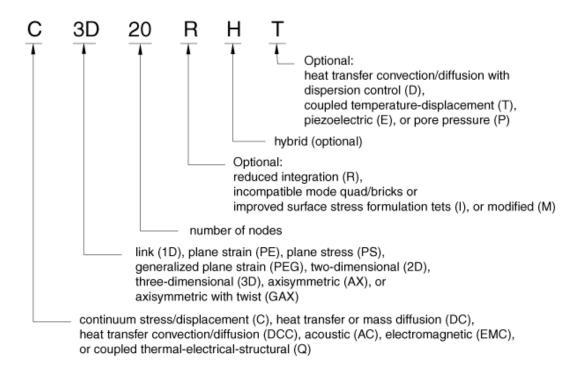
Rigid elements



Truss elements

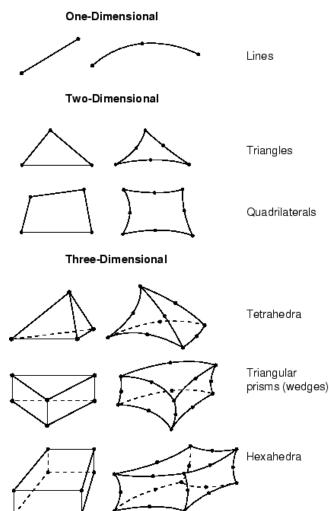


Element Naming Convention





Element Selection & Properties

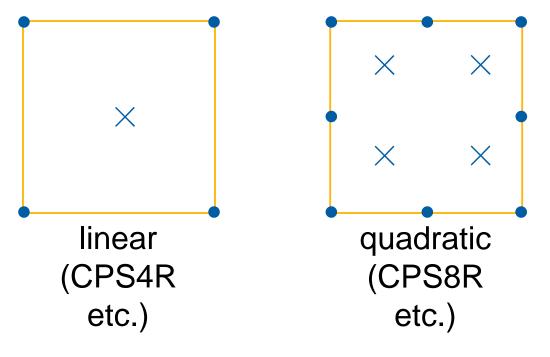


Topologically, CPE4 = CAX4R = S4R = DC2D4 = AC2D4 No checking of DOFs in CAE

Standard C Explicit Seometric Order Acoustic Cohestive Cohestive Continuum Shell Continuum Shell Hex Wedge Tet If Hybrid formulation If Reduced integration If Encompatible modes Element Controls If Use default Hourglass stiffness: If Use default Viscosity: Is use default Specify	
Geometric Order Cohesive Continuum Shell Hex Wedge Tet Tet Hybrid formulation Reduced integration Element Controls Hourglass staffness: Cohesive	
Element Controls Hourglass stiffness: @ Use default @ Boenfy	
Element Controls Hourglass stiffness: @ Use default @ Boenfy	
Hourglass stiffness: I Use default I Giocofy	
Microsoft G. Line default C. Speedfy	
vacuality: vacuation vacuation	
Kinematic split: Average strain C Orthogonal C Centroid	
Second-order accuracy: C Yes C No	
Distortion control: C Use default C Yes C No	
Lenatin ratio: 0.1	
C3DBR: An B-node linear brick, reduced integration, hourglass control.	
ster: To select an element shape for meshing, select "Mesh->Controls" from the main menu bar.	



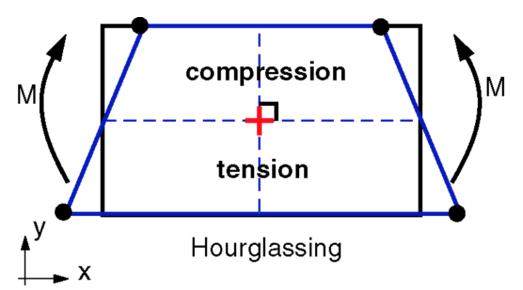
Reduced Integration



C3D20R -> 27 ->8

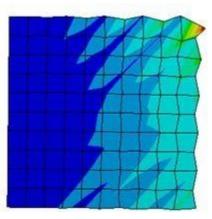


Hourglassing



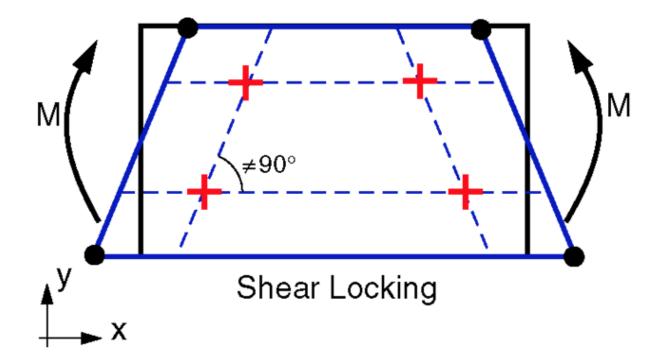
Total Deformation Type: Total Deformation Unit: mm Time: 1 04.02.2008 14:13





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Shear Locking



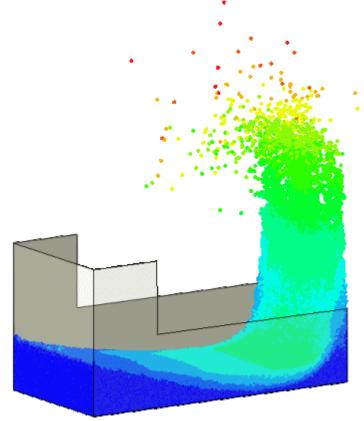
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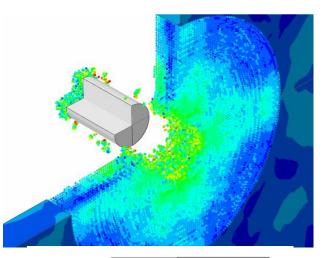
ABAQUS Elements Formulation methods

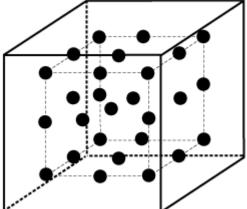
- Lagrangian Mesh moves with material
- Eulerian Mesh stays stationary
- ALE Mesh moves independent of material



SPH/CEL (Smoothed Particle Hydrodynamics/Coupled Lagrangian Eulerian) Mesh free methods







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