

SIMULIA in Medical Devices Industry

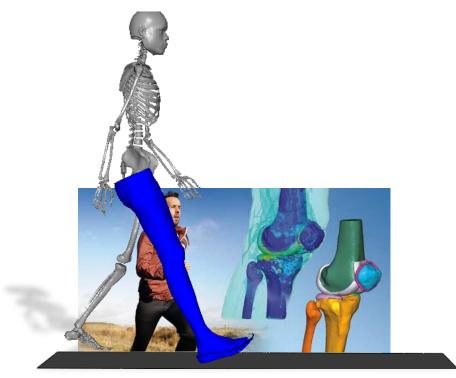






Realistic Simulation is ...

The use of Unified FEA, multiphysics and optimization technology and methods to understand and improve how products will perform in life

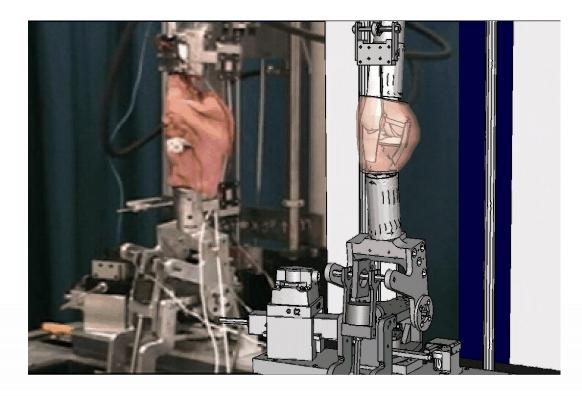


- Evaluate design alternatives
- Reduce physical prototypes
- Increase confidence in product performance
- Accelerate design decisions
- Gain knowledge of real-world behavior
- Aid FDA submission

... Lifelike Experience through Simulation







to **Reduce** Physical Testing, **Save** significant **Time** and **Money**

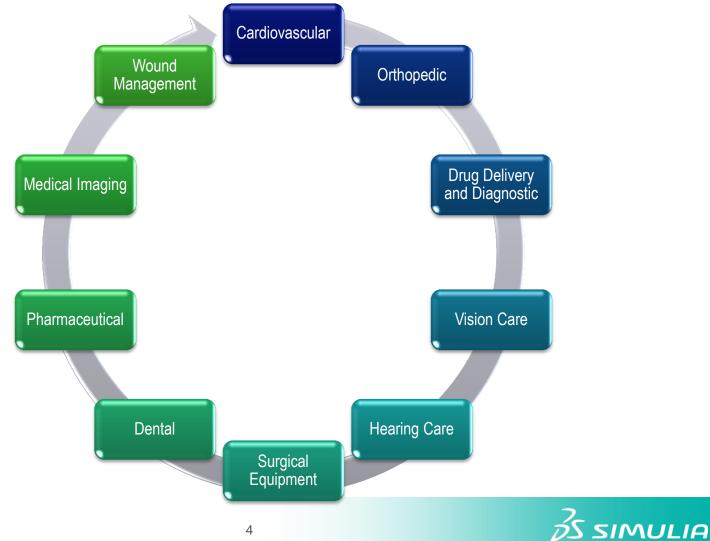




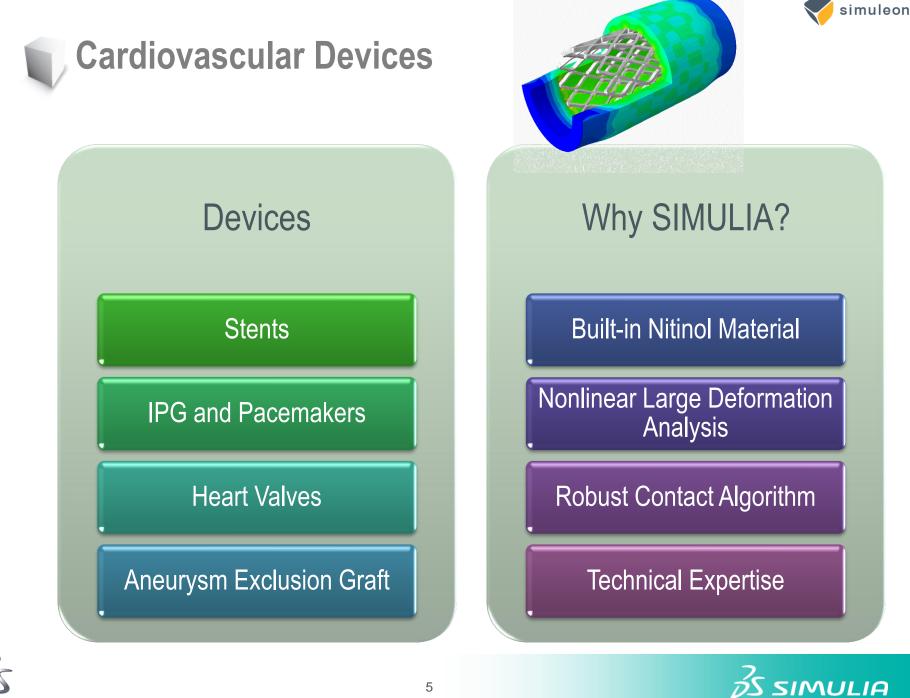


SIMULIA in Medical Devices Industry

Industry Segments



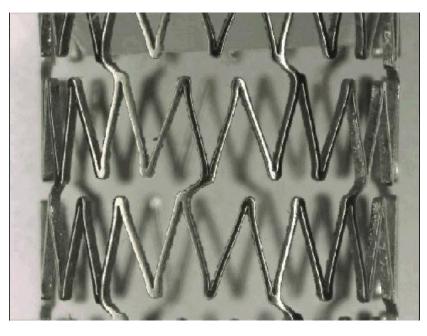


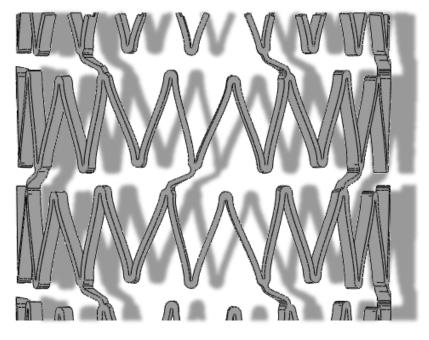












Test data

Abaqus data

Test data courtesy SRI. Abaqus model courtesy NDC

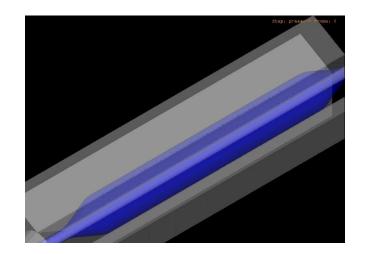
Simulation of Bench Test to Validate FEA Solution



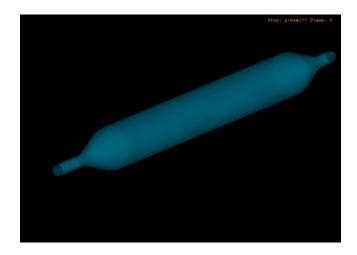








Assembly level interactions



Balloon forming process

Courtesy : NDC

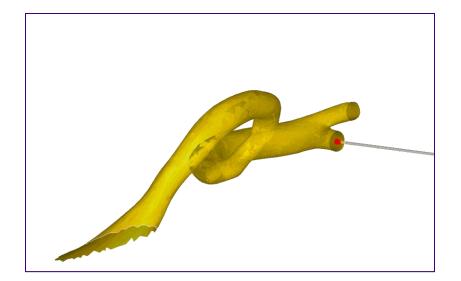
Angioplasty Balloon Forming











Advancing a Guide Wire

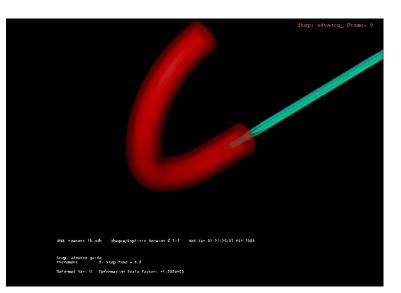
Ref: SIMULIA User's Conference, 2010, Atul Gupta, Medtronic

Courtesy : NDC

Balloon Expansion





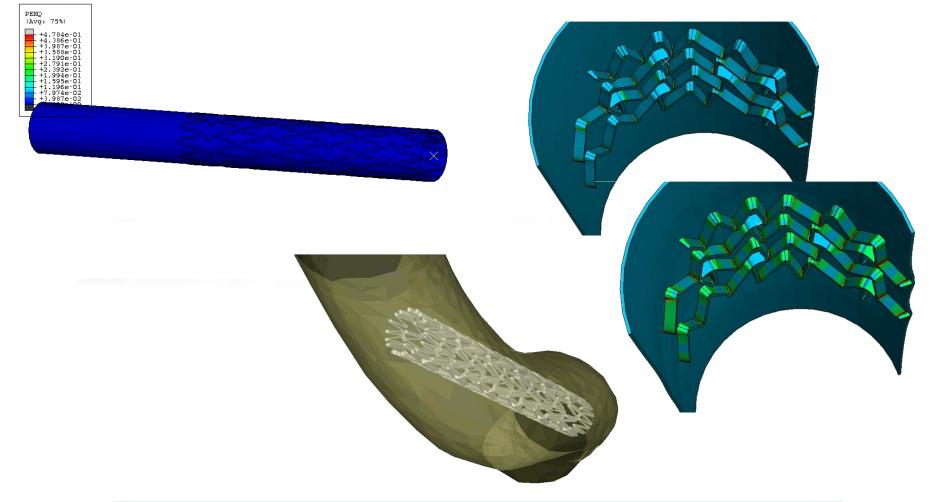








Cardiovascular Devices – Stents



Stent Manufacturing, Deployment and Fatigue Analysis

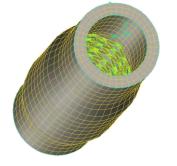


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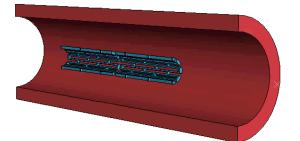


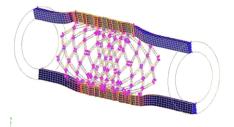


Cardiovascular Devices – Stents

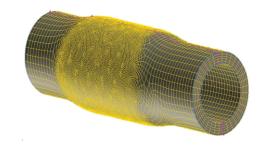


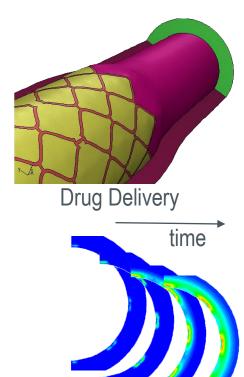
Structural deployment





CFD mesh creation from the deformed structure



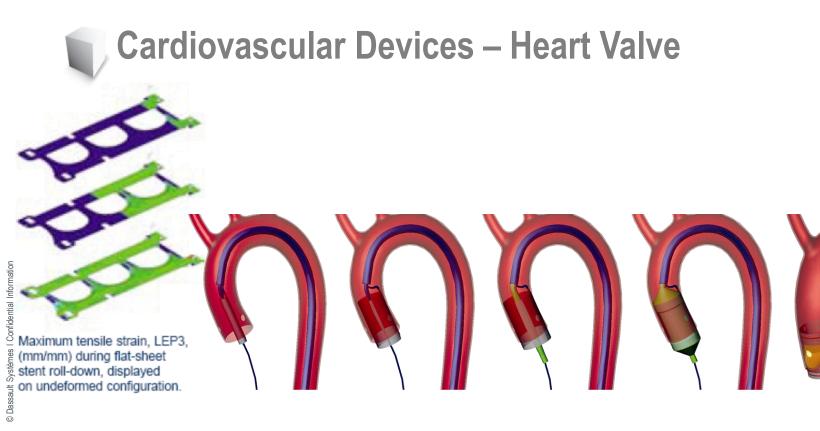


Simulation of Drug Diffusion into the Surrounding Tissue









Ref: 2004 Abaqus User's Conference, Edwards Lifesciences

Stent Mounted Heart Valves

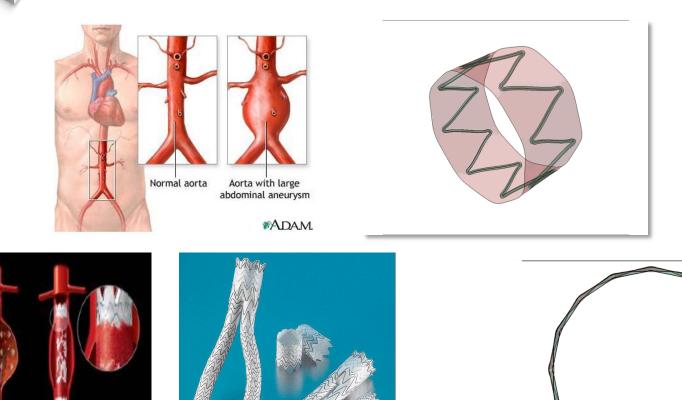




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Cardiovascular Devices – Stent Graft





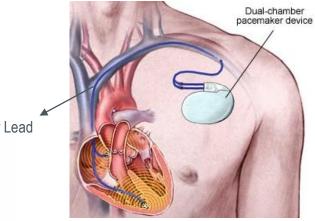


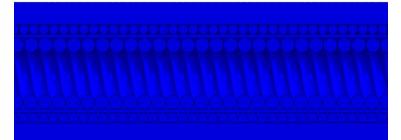


Cardiovascular Devices – Cardiac Rhythm Management



Pacemaker Lead





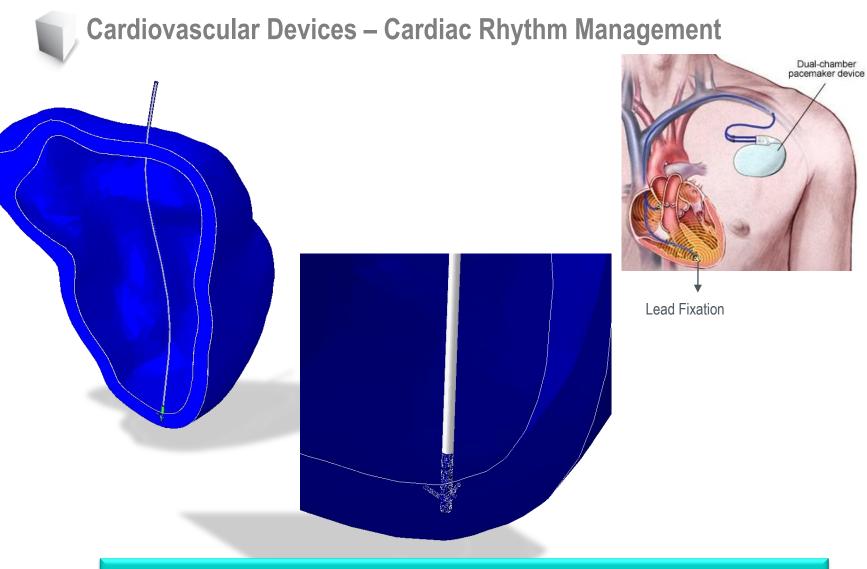


Pacemaker Lead Stress Analysis









Pacemaker Lead Fixation Analysis

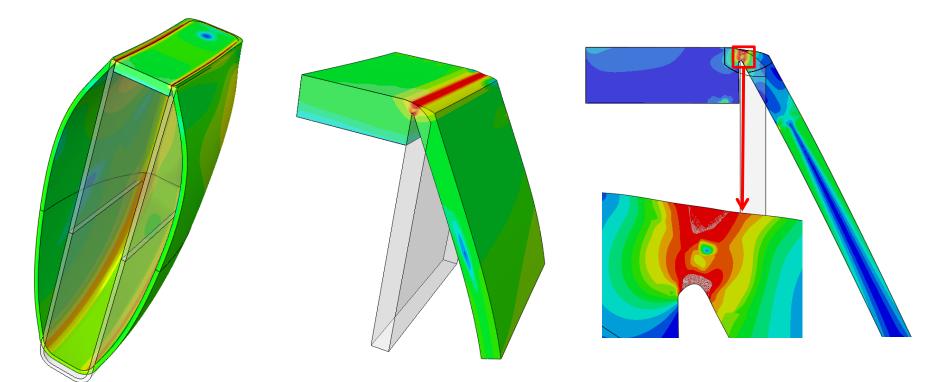








Cardiovascular Devices – Cardiac Rhythm Management



Ref: 2010 SIMULIA Customer Conference, Medtronic

Fracture Analysis of Battery Can for Implanted Pulse Generator









Joint Replacement

Surgical Planning

Body Support

Trauma Care

Why SIMULIA?

Advanced Material Models

Robust Contact and Wear Analysis

Fracture and Failure Analysis

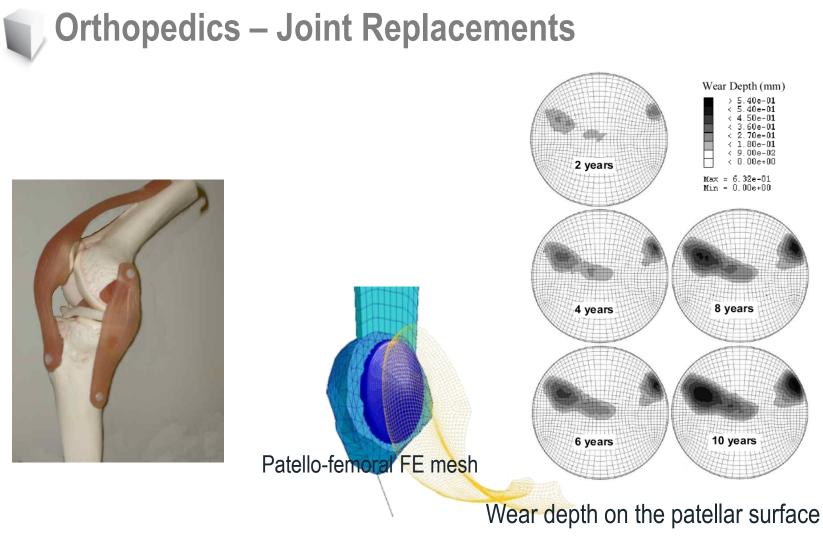
Designer Friendly Interfaces



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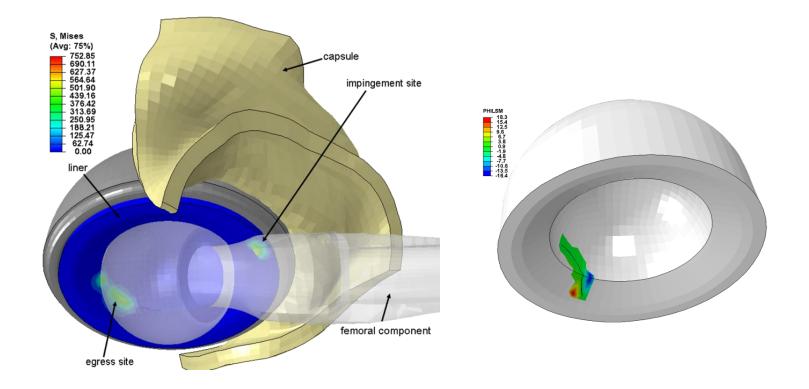
Ref: 2002 Abaqus User's Conference, DePuy Orthopaedics

Wear Prediction





Orthopedics – Joint Replacements

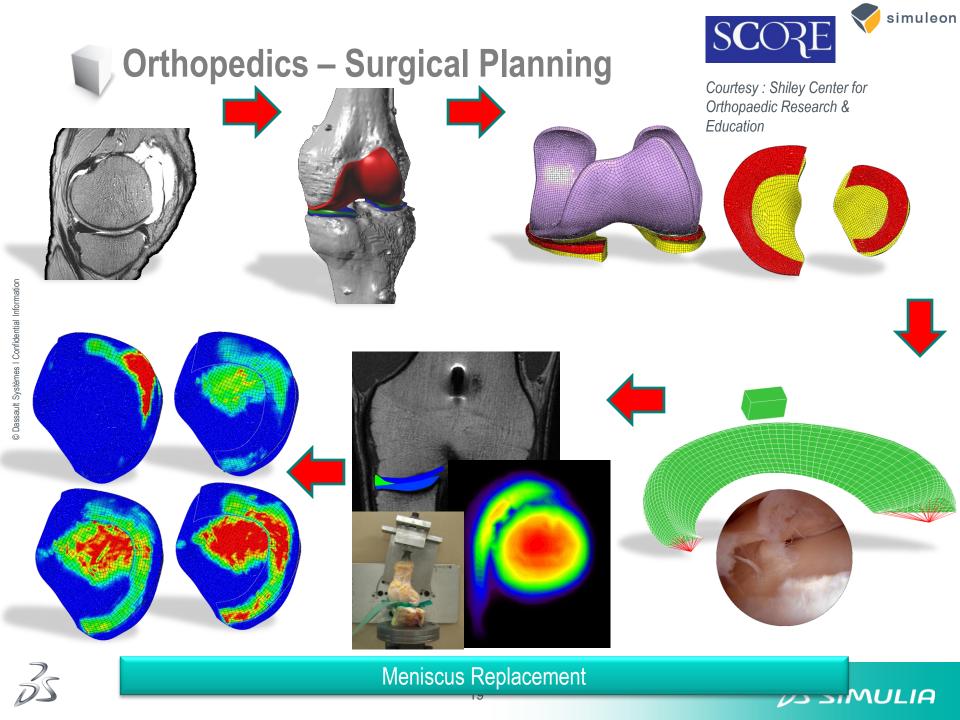


Ref: 2011 SIMULIA Customer Conference, University of Iowa and SIMULIA

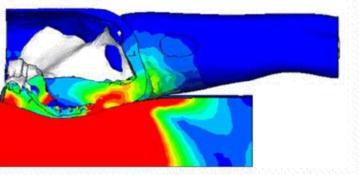
Ceramic Hip Socket Liner Fracture Analysis



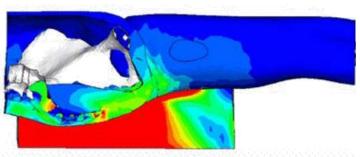




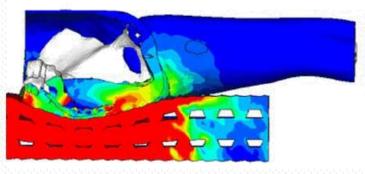
Orthopedics – Soft Tissue and Support



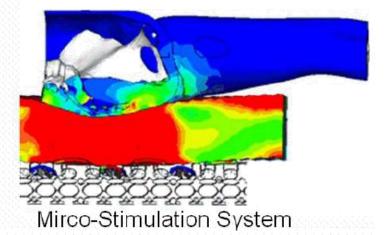
Cold-Cure Foam



Highly Viscoelastic Foam



Soft Foam Composite



Ref: 2009 SIMULIA Customer Conference

Comparison of Body Supports to Reduce Pressure Ulcers



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СВМЕ



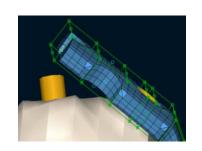
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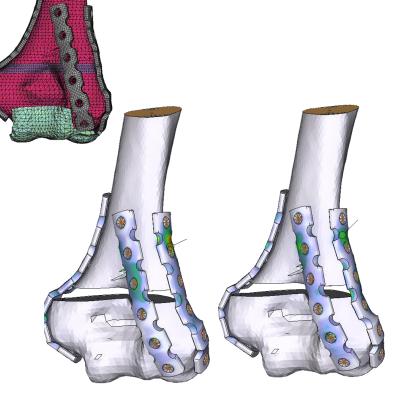
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Orthopedics – Trauma Care









Frontal bending sagittal bending 3-PLATE configurations, stress in plates

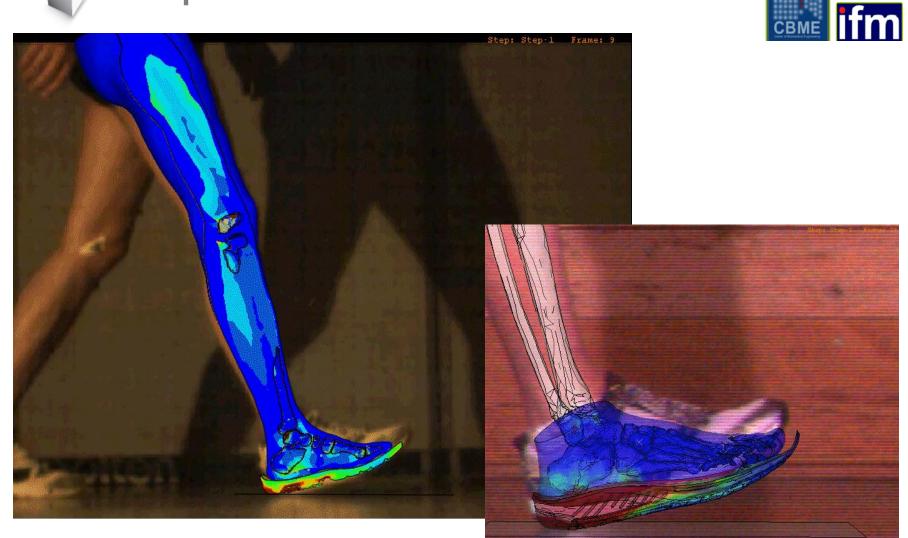
Fixation Techniques of a Fractured Distal Humerus











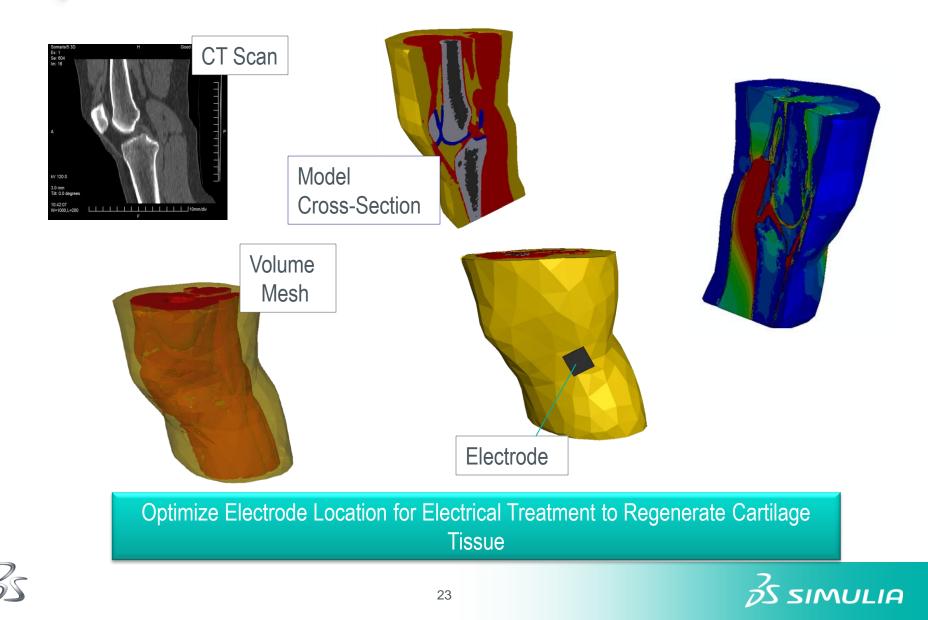
Gait and Tissue Stress Analysis for Shoe Sole Design







Orthopedics – Tissue Regeneration







Devices

Syringes

Automatic Injectors

Catheters and Fluid-filled Bags

Septums

Why SIMULIA?

Nonlinear Large Deformation Analysis

Robust Contact Algorithm

Fracture and Failure Analysis

Multiphysics Capabilities

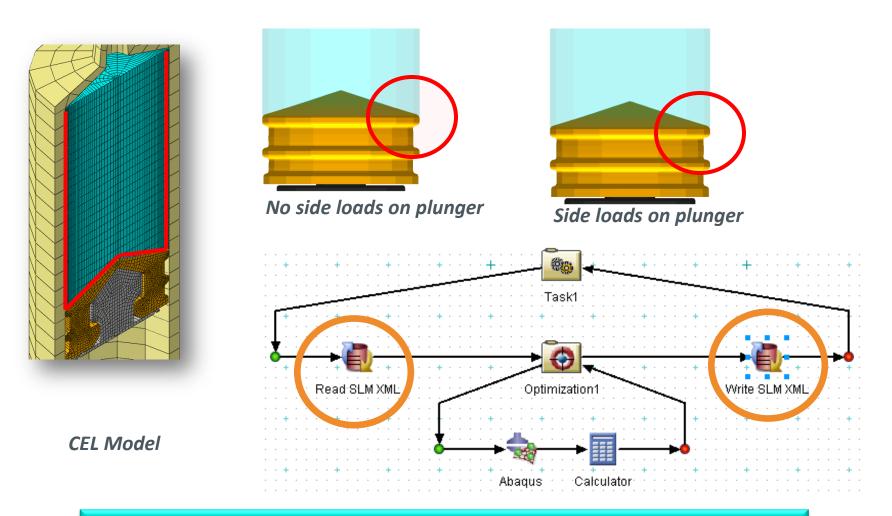






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Drug Delivery – Disposable Syringe



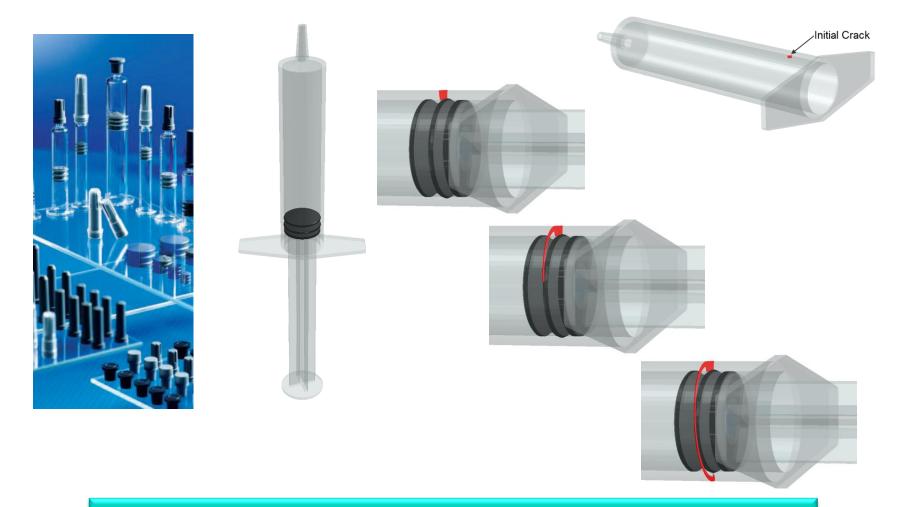
Plunger Design Optimization Using Isight to Reduce Leakage





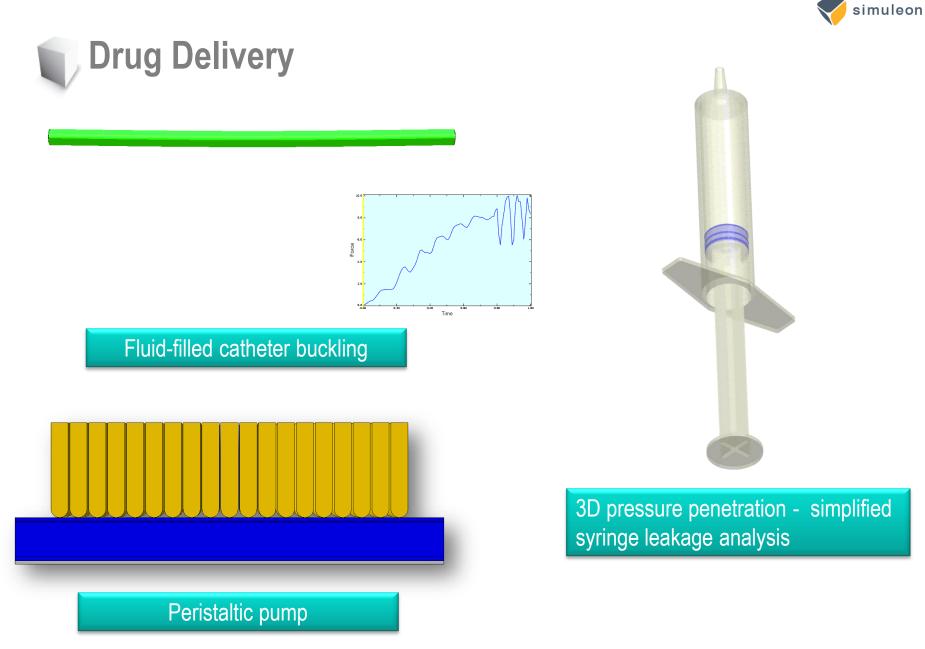
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Drug Delivery – Prefilled Syringe



Syringe Barrel Failure Analysis

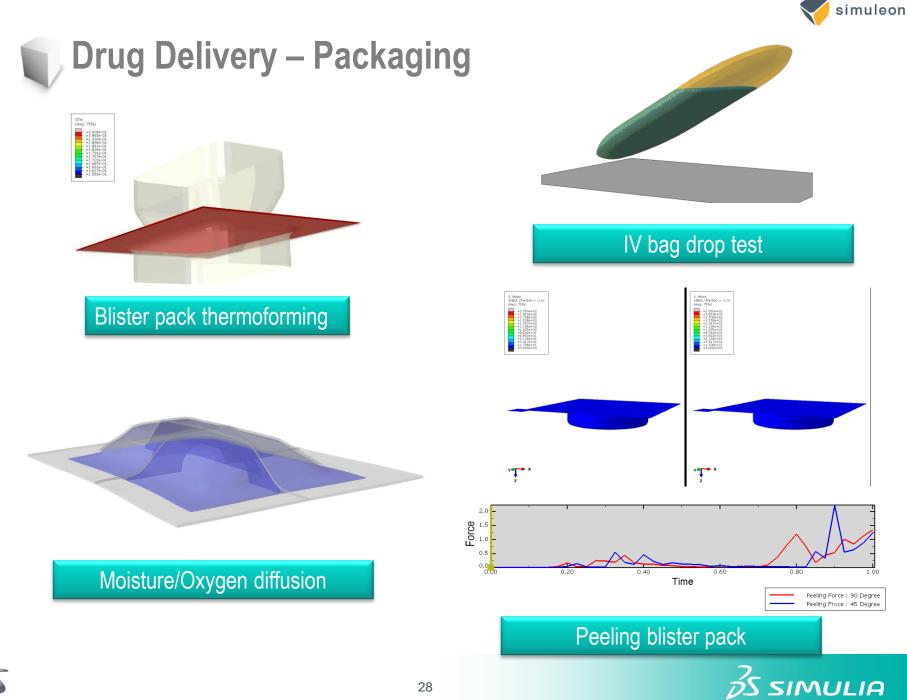






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Devices and Processes

Hearing Aids

Eye Implants

Dental Implants

Tablet Compaction

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Why SIMULIA?

Nonlinear Large Deformation Analysis

Robust Contact Algorithm

Nonlinear Material Models

Multiphysics Capabilities





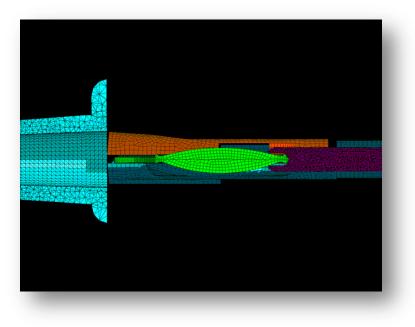






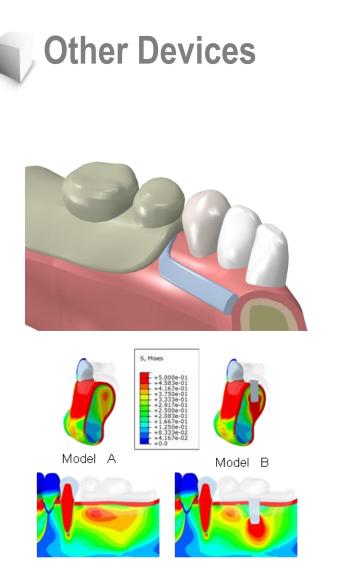


BAUSCH+LOMB



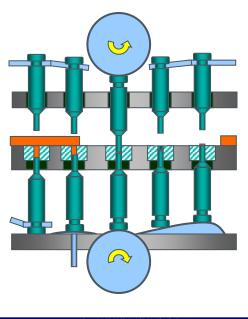
Intraocular Lens Insert

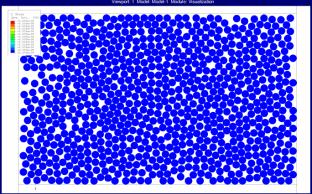




2011 SIMULIA User Conference, C.M Rocha and S.M. Arndt

Bone Remodeling Around Dental Implant





Ref: 2005 Abaqus East Regional Users Meeting, Merck

Tablet Compaction



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In Summary – Why SIMULIA?

Industry leading technology for materials, contact, and nonlinear modeling

Leading computational mechanics researchers and material modeling developers work in SIMUL!A

Our services teams have hundreds of man-years of experience in device design and assisting with submittal work

Only software company to disseminate best practices knowhow to end-users









Actively involved with ASME and ASTM on development of simulation guidelines for Medical Devices industry

Abaqus is the de-facto realistic simulation provider for the medical device industry

Isight has powerful tools for stochastics and probabilistic analysis and the community feels the need

We continue to push new technology areas







www.simulia.com

Public Website

- Life Sciences Solution
- Technology brief
- Knowledge database
 - Customized extensions
- Events and webinars
- Customer Conference papers
- Customer References
- Realistic Simulation News

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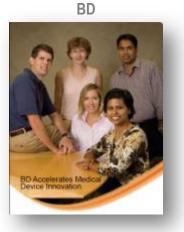






Realistic Simulation News

Recent issues





Smith & Nephew



35

Smith & Nephew

- knee replacements
- Mobelife
 - personalized hip implants
- Wölfel
 - automotive seat comfort
- Bausch + Lomb
 - cataract lens insertion
- University of Denmark
 - skull fracture
- Haddassah University:
 - femoral fracture fixation





SIMULIA in Medical Devices Industry



