

Infoday LS-DYNA/Implicit

Introduction

Alexander Gromer, Tobias Erhart
Stuttgart, 23. February 2016

Copyright: Dynamore GmbH, Industriestr. 2, 70565 Stuttgart

DYNAmore GmbH - Company

■ Countries and their Headquarters

- Headquarters in Stuttgart
- Nordic – headquarters in Linköping
- Swiss – headquarters in Zurich
- Italia – headquarters in Torino
- France – headquarters in Versailles



■ Further Offices

- Ingolstadt
- Dresden
- Langlingen (Wolfsburg)
- Berlin

■ On-site Offices

- Sindelfingen (Daimler AG)
- Weissach (Porsche)
- Ingolstadt (Audi)
- Gothenburg (Volvo)



Stuttgart [Headquarters]

DYNAmore GmbH - People

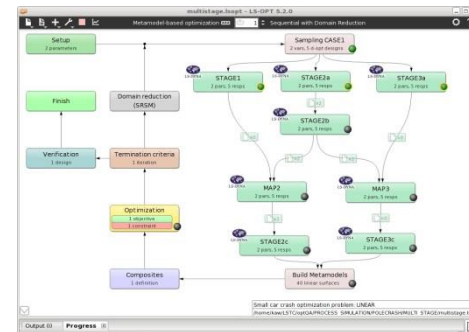
- **Who we are**
 - In total close to 100 people
 - Civil and mechanical engineers, mathematicians, computer scientists,...
 - The employees are from 13 different countries



DYNAmore GmbH - Products

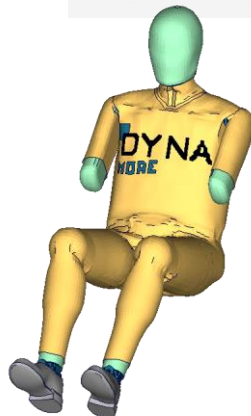
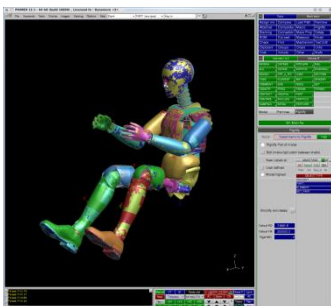
■ Software

- LS-DYNA
- LS-OPT und LS-TASC
- LS-PrePost
- eta/DYNAFORM
- FEMZIP
- Digimat
- OASYS Primer



■ Models

- FAT/PDB dummy models
- Humanetics dummy models
- THUMS human model
- Arup barrier and impactor models
- Daimler/Porsche impactor models
- LSTC models



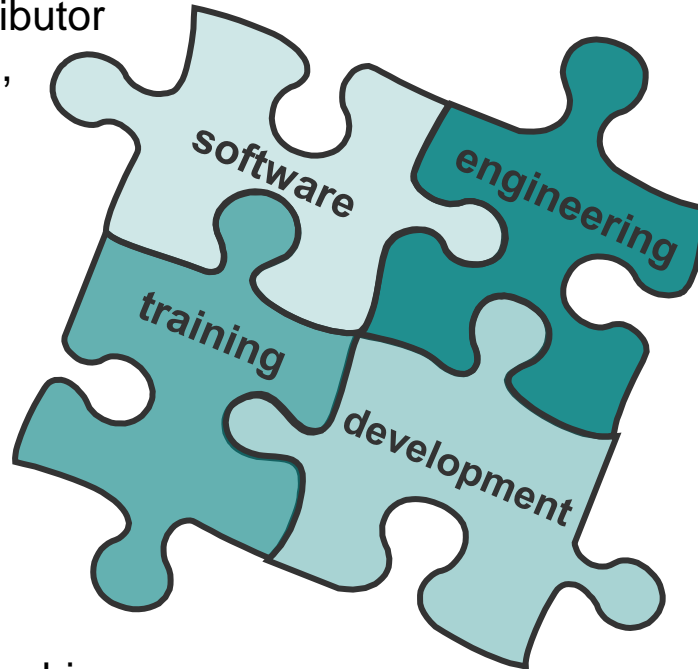
DYNAmore GmbH - Services

Software

- European master distributor for LS-DYNA (w/o UK), plus Turkey

Training

- Conferences
- Support
- Seminars & on-site coaching



Engineering

- Benchmarking
- Pilot projects

Development

- Software development
- Material & dummy models
- System & process integration
- Customization & method development

German LS-DYNA Forum 2016 - Call for Papers

- The 14th German LS-DYNA Forum will be held from **10-12 October 2016 in Bamberg, Germany.**
- We kindly invite you to participate and encourage you to actively contribute to the conference agenda by submitting a presentation about your experience with the LSTC products.
- Participation without a presentation is also worthwhile to exchange your knowledge and discuss new solution approaches with other users



Motivation: Why implicit ?

pre-stressed, quasi statically loaded structures

long duration analysis > 500 ms

different time scales in process

e.g. static loading followed by transient loading
or transient loading followed by static loading

applications

e.g. metalforming, roof crush, door sag, dummy seating, strength analysis, ...

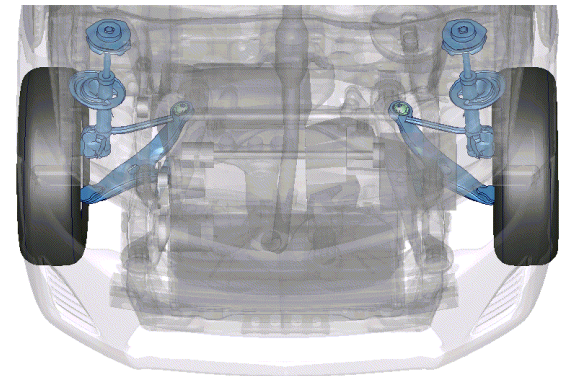
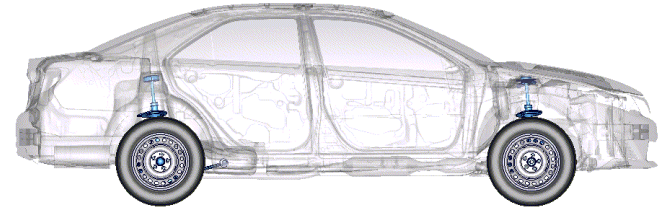
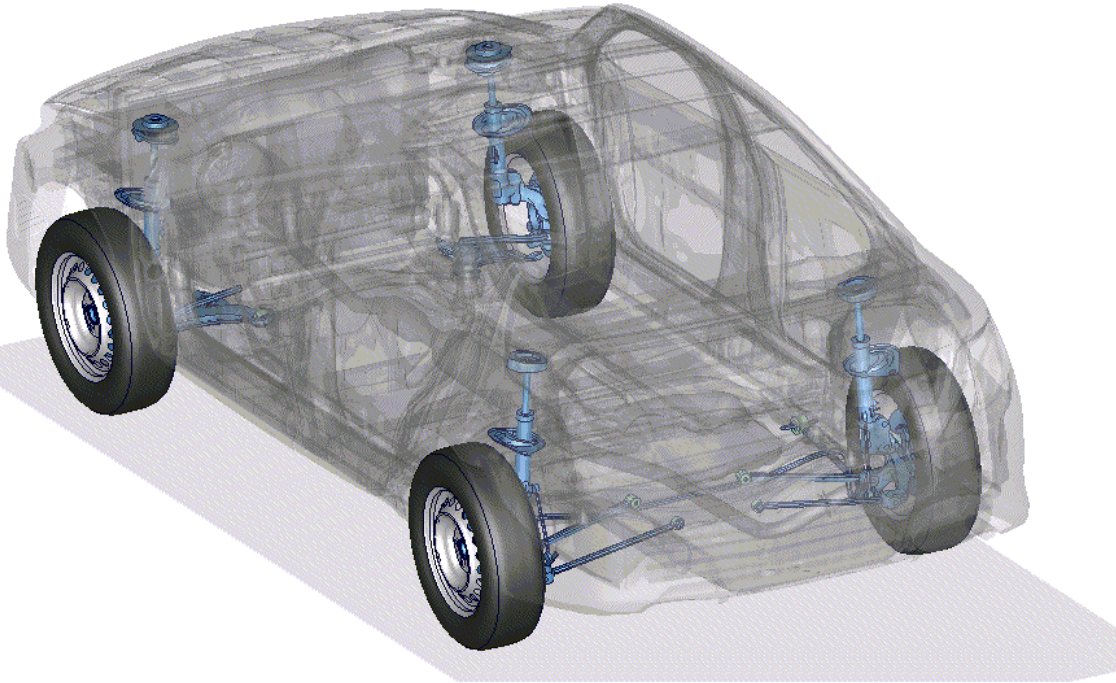


LS-DYNA provides explicit and implicit solution schemes

one code – one license - one data structure - one input / output

Examples

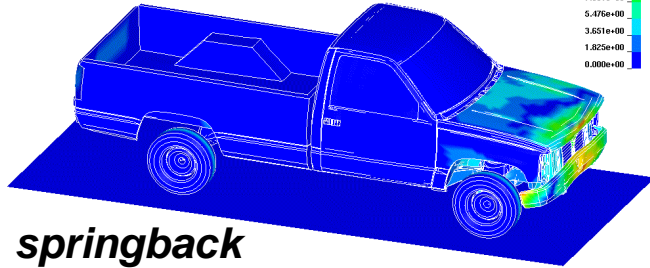
static gravity load with inflated tires



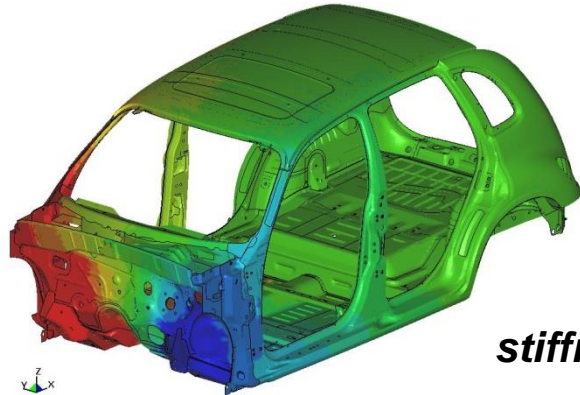
Implicit Dynamics SpringBack

Time = 0.02
Contours of Resultant Displacement
min=0, at node# 110570
max=17.2191, at node# 4

Fringe Levels



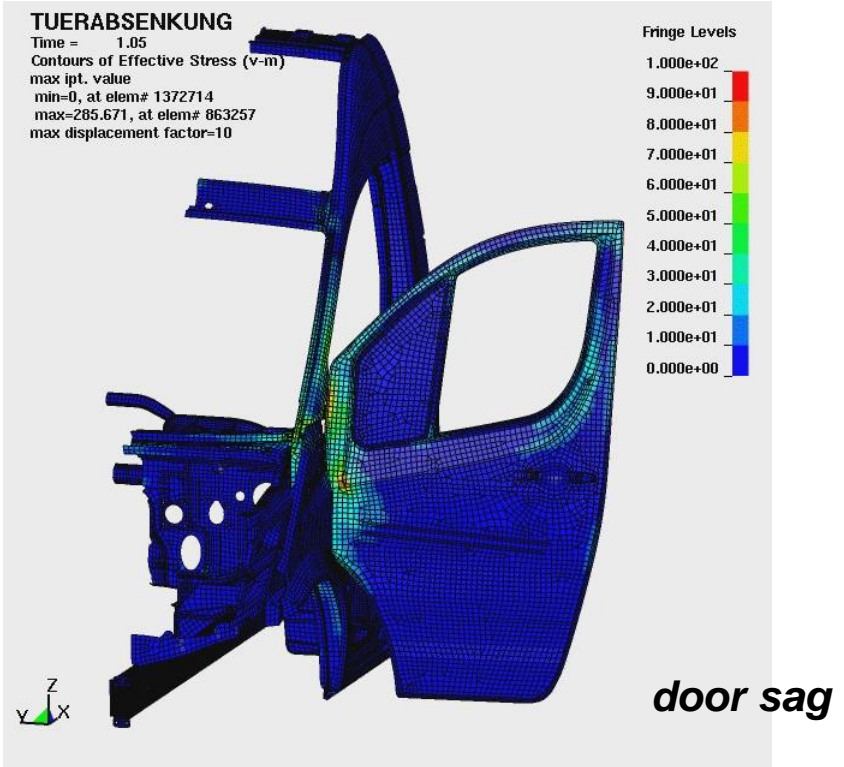
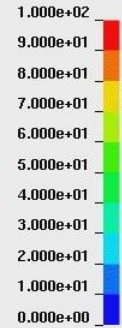
Examples



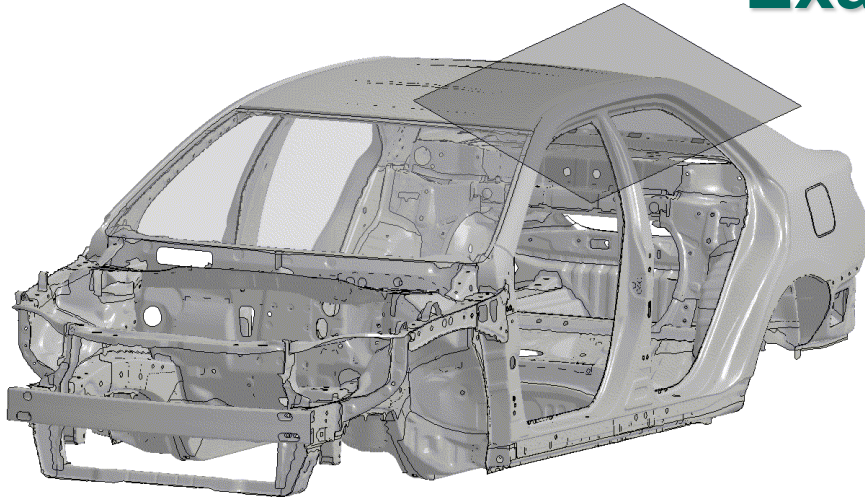
TUERABSENKUNG

Time = 1.05
Contours of Effective Stress (v-m)
max ipt. value
min=0, at elem# 1372714
max=285.671, at elem# 863257
max displacement factor=10

Fringe Levels

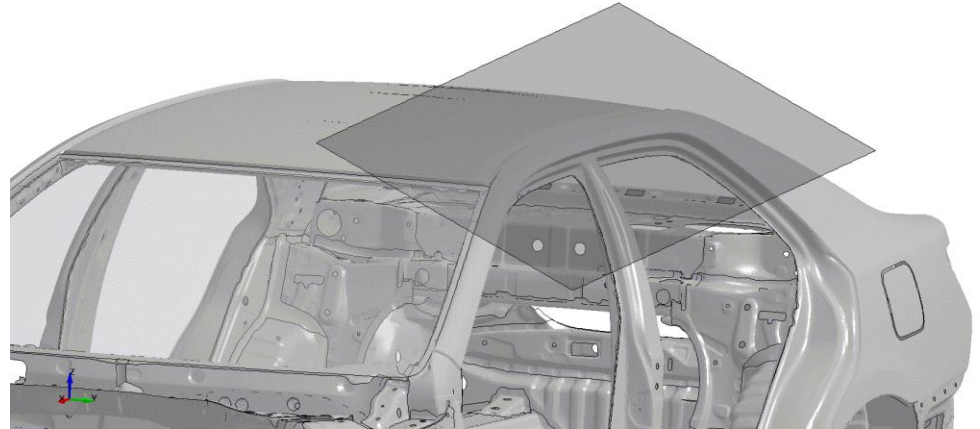


Examples



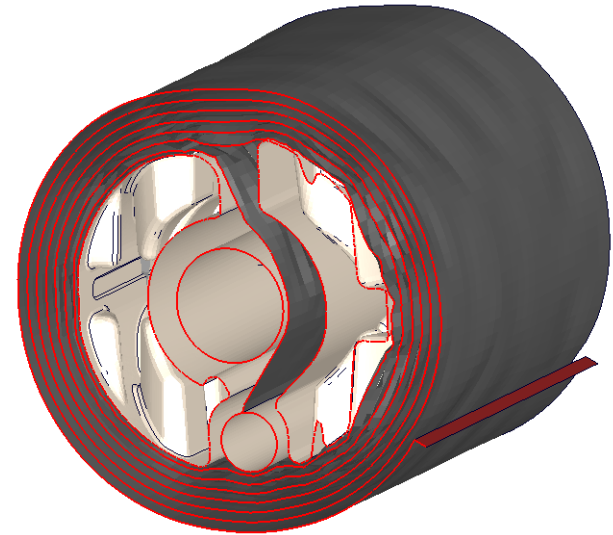
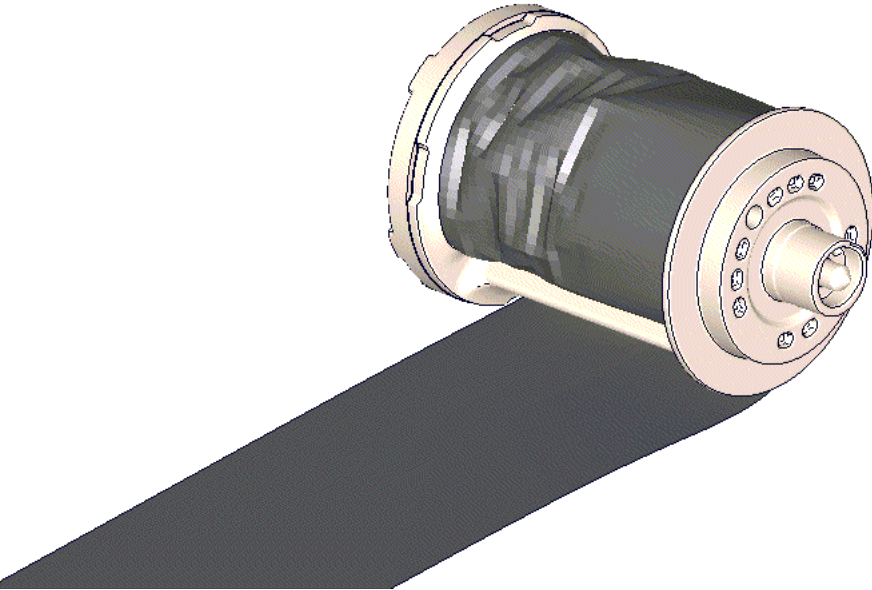
LS-DYNA keyword deck by LS-PrePost
Time = 0

roof crush



Examples

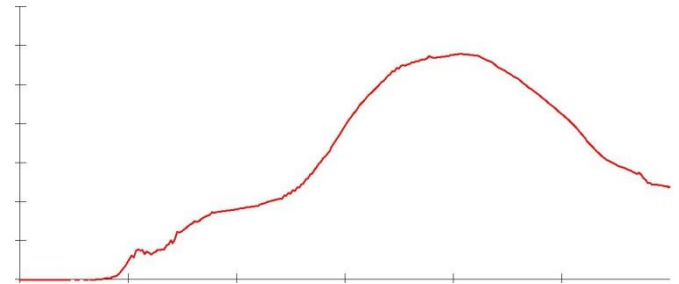
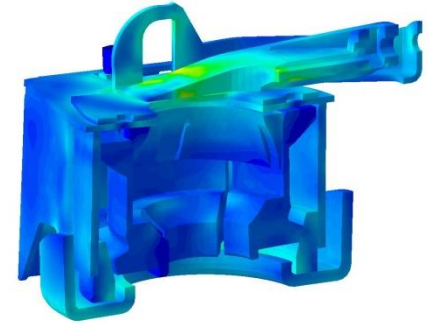
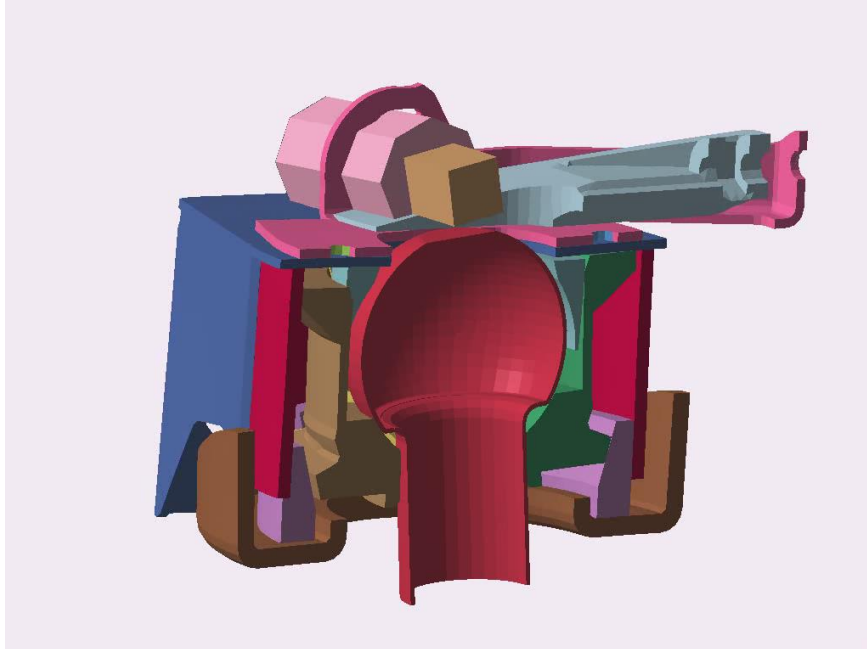
belt spool



Courtesy of ZF TRW

Examples

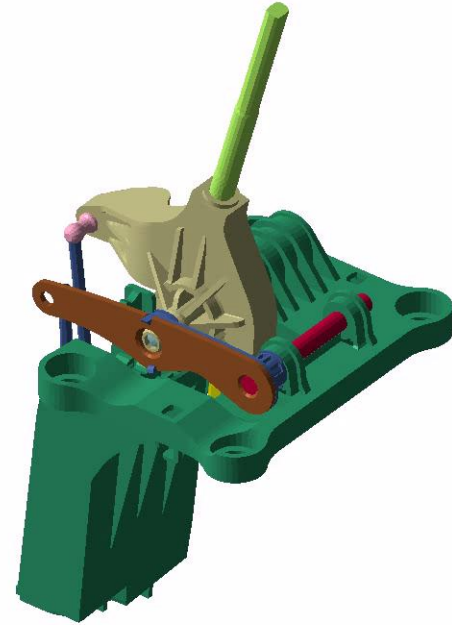
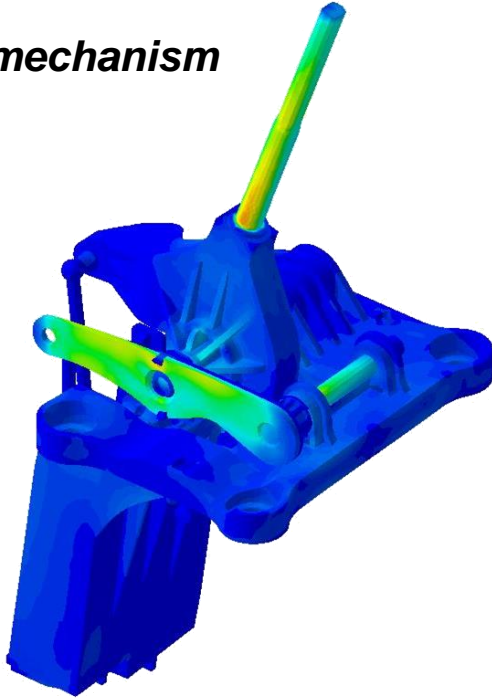
hitch mounting



Courtesy of THULE Sweden

Examples

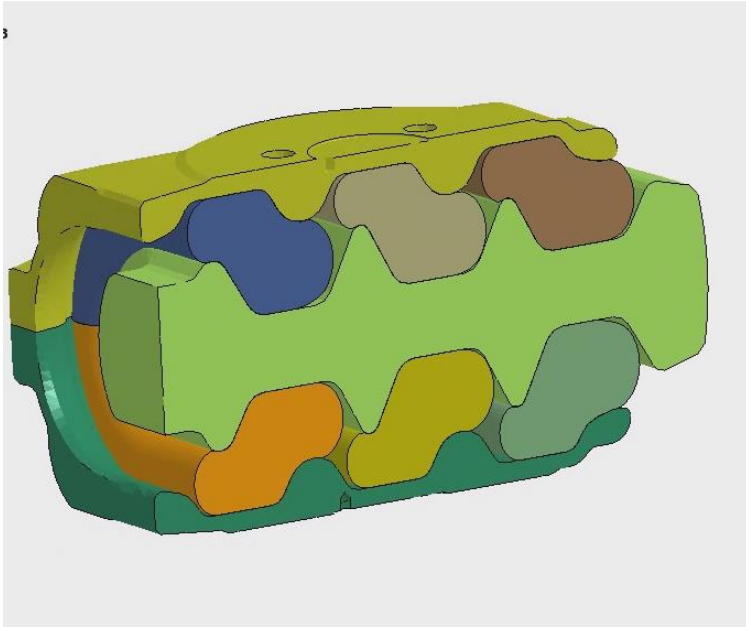
gear box mechanism



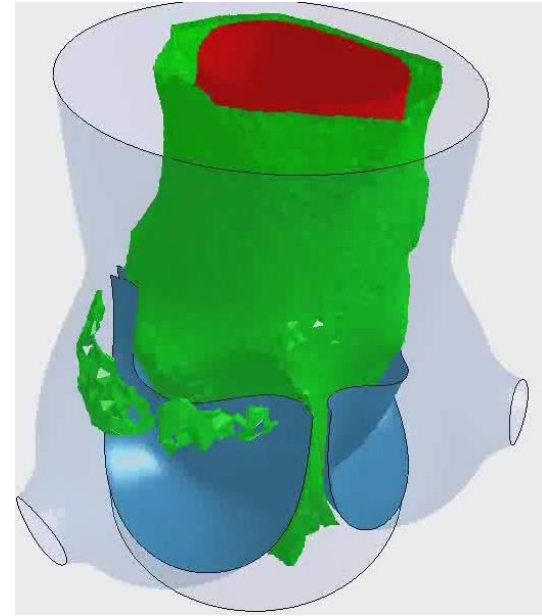
Courtesy of Kongsberg Automotive Sweden

Examples

rubber bushing



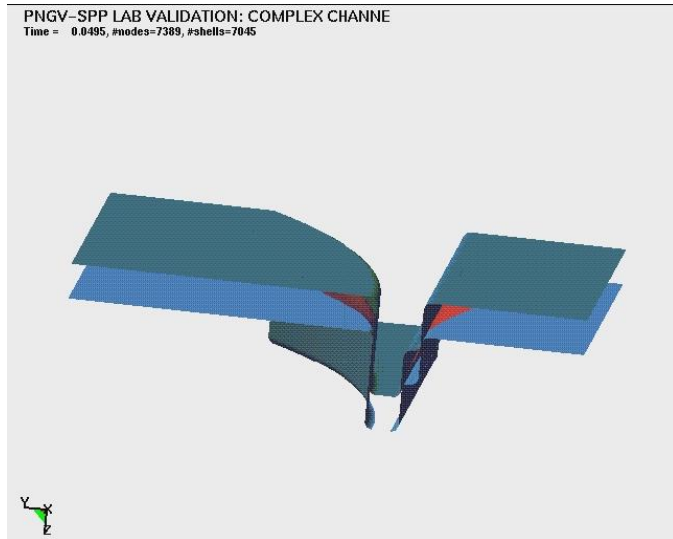
Courtesy of Dellner Couplers AB



heart valve with FSI

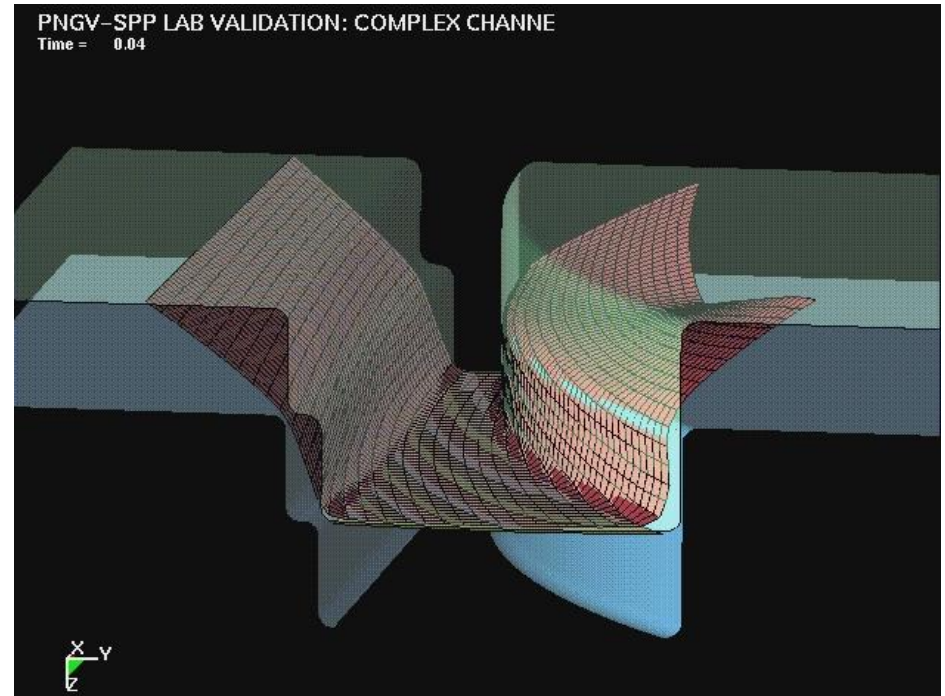
Examples

explicit

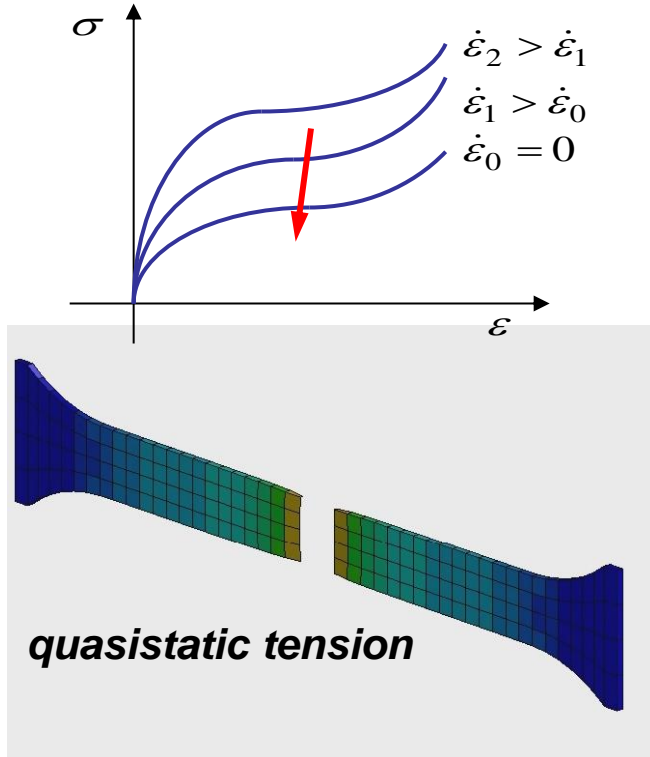


metal forming

implicit



Examples

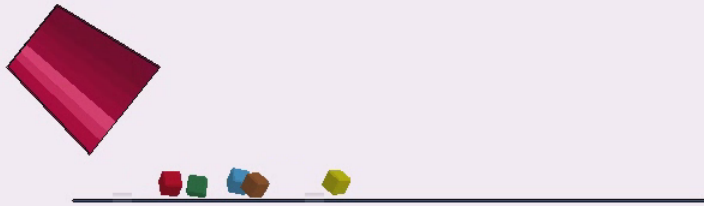


component testing

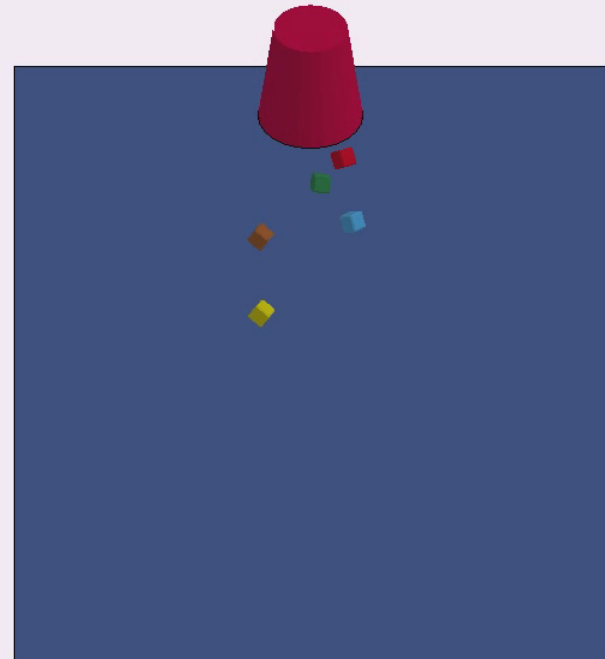
Examples

gambling

Time = 1.91



Time = 1.91



LS-DYNA Implicit Features

Basic equipment

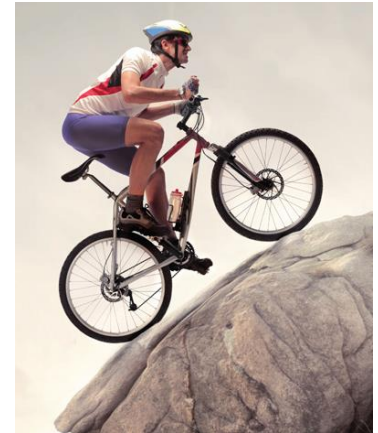
- Newton, Quasi-Newton, arclength methods
- direct and iterative solvers
- automatic step size adjustment
- Newmark methods with consistent mass matrix
- ...



LS-DYNA Implicit Features

Outstanding features

- one code – one license – one input – one output
- switching between implicit and explicit in one run
- high scalability through MPP
- mortar contact
- post-processing of residual (out-of-balance) forces



13:30 Begrüßung und Einführung

A. Gromer (DYNAmore)

13:45 Dummy-Positionierung für Whiplash-Lastfälle mit LS-DYNA Implizit

A. Hirth (Daimler)

**14:15 LS-DYNA Implizit für die Berechnung von Kunststoffzahnradern
und Getrieben**

E. Stoppel (IMS Gear)

14:45 Kaffeepause

15:00 Einige Beispiele für Anwendungen der impliziten Funktionalität von LS-DYNA aus dem Bereich des Maschinen- und Anlagenbaus

M. Pitzer (TH Mittelhessen)

15:30 Tipps und Tricks für eine erfolgreiche implizite Simulation mit LS-DYNA

T. Erhart (DYNAmore)

16:00 Fragen & Diskussion

17:00 Ende