

*8th International Forging Conference/Brasil
(24th Senafor)*

Some ideas about simulation:

The possible gap between what simulation systems could do for you and what you do with simulation systems

*G. H. Arfmann, M. Twickler
AE Arfmann Engineering, CPM GmbH, Germany*

21st of October 2004



(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- Availability of reliable data (material, friction, physical properties)
- Designing of cold forming process (process and tool design)
- Avoiding of failures
 - cracking of the part (in two pieces)
 - failure of a punch
 - folding at the part
 - pre-stressing-system design
- Prediction of microstructure
- 3D or 2D ? What is the right choice?
- Administration of data

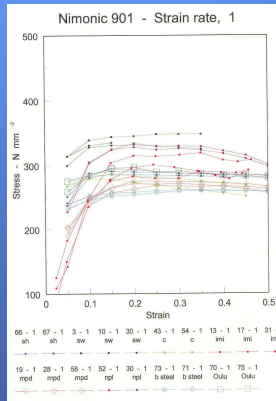
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Correct material data
- Yield-Stress-Strain curve
Quality
Source
Documentation

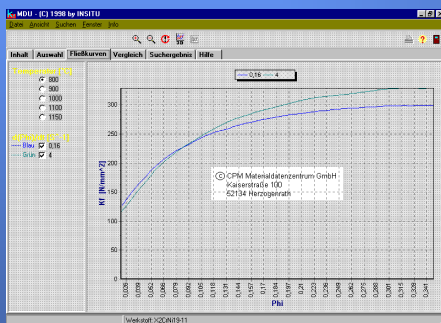
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Correct material data
- Yield-Stress-Strain curve
Quality
Source
Documentation

21st of October 2004

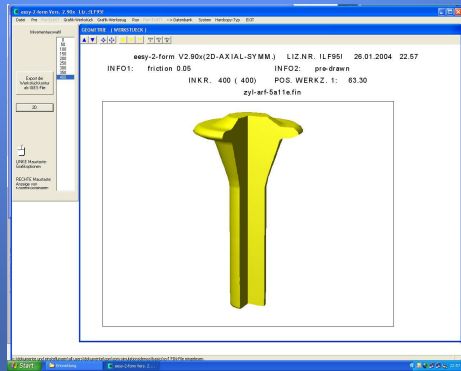
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- boundary conditions



Correct friction and temperature?

Influence on

- correct material flow
- correct load

$\mu=0.05$, temp.= 25°C,
pre-drawing

21st of October 2004

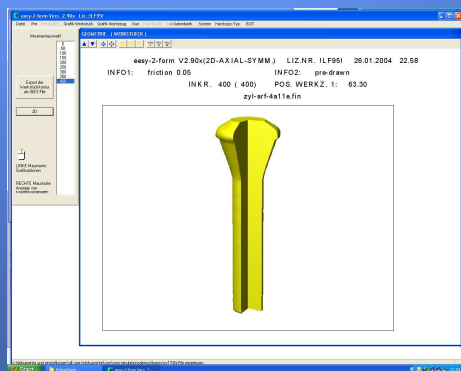
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- boundary conditions



Adaptation of friction and temperature

Influence on

- correct material flow
- correct load

$\mu=0.05$, temp.= 80°C, pre-drawing

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



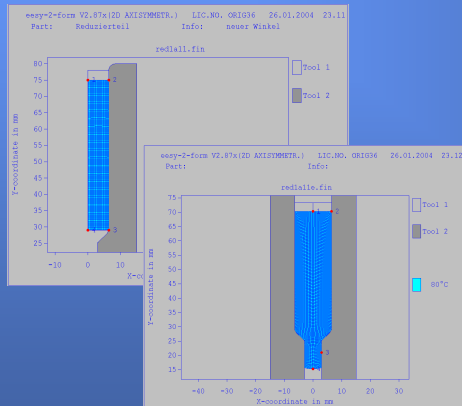
8th International Forging Conference/Brasil

Some ideas about simulation.....



- Design of a cold forming process

Simulation of an extrusion

Material flow



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



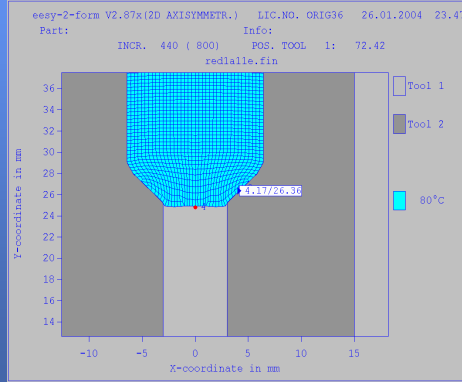
8th International Forging Conference/Brasil

Some ideas about simulation.....



- Design of a cold forming process

Simulation of an extrusion

Material flow



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



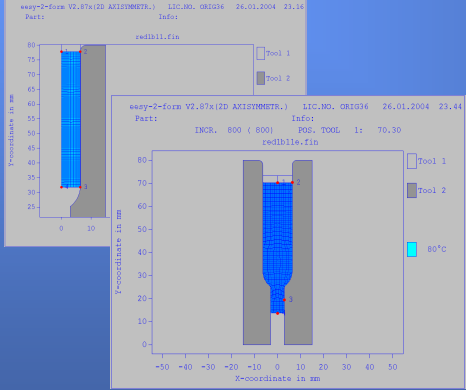
8th International Forging Conference/Brasil


Some ideas about simulation.....

- Design of a cold forming process

Simulation of an extrusion

Material flow



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

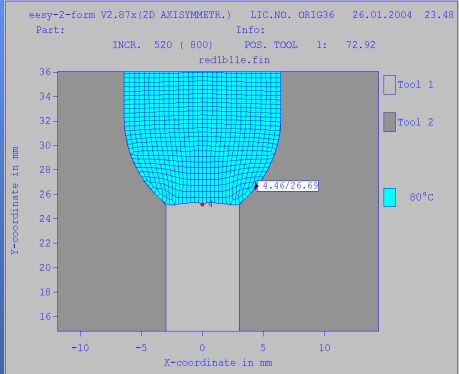
8th International Forging Conference/Brasil


Some ideas about simulation.....

- Design of a cold forming process

Simulation of an extrusion

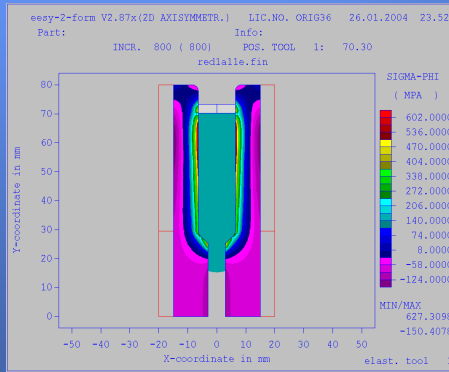
Material flow



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

8th International Forging Conference/Brasil

Some ideas about simulation.....



- Design of a cold forming process

Tool design

Stress in the die without pre-stressing

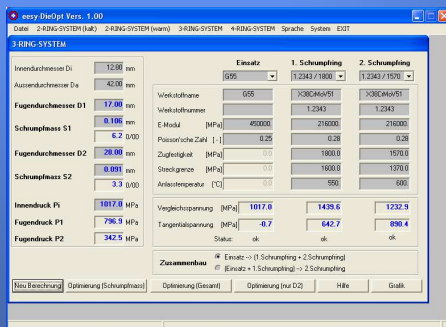
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Design of a cold forming process

Tool design

Design of a multi-ring pre-stressing-system

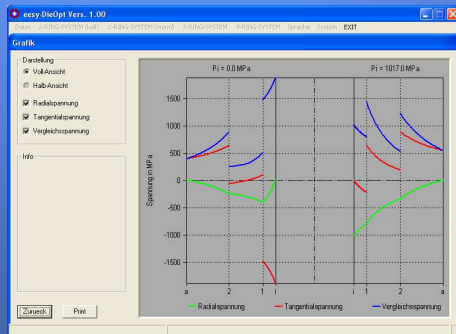
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Design of a cold forming process

Tool design
Design of a multi-ring pre-stressing-system

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Production of a spark plug

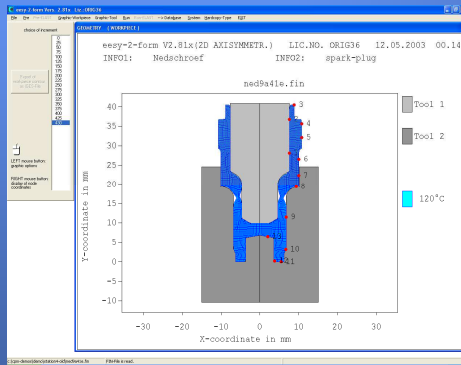
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Production of a spark plug

Cracking of the part (in two pieces) because of wrong adjustment

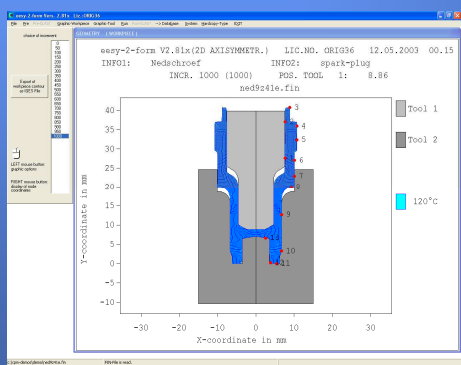
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Production of a spark plug

Correct adjustment

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Failure of a punch

Bad pre-form design

21st of October 2004 (c) 2004 AE, CPM GmbH, Germany  

8th International Forging Conference/Brasil

Some ideas about simulation.....



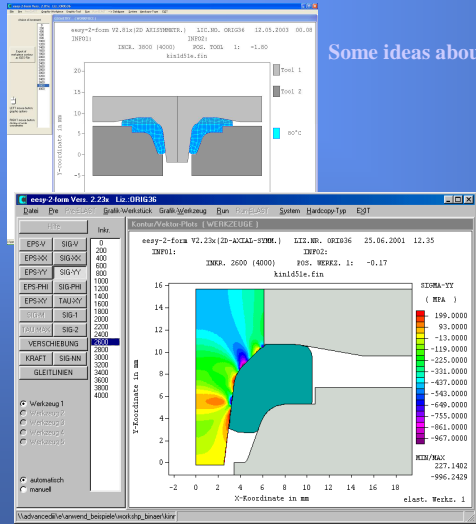
- Avoiding of failures

Failure of a punch

Bad pre-form design

21st of October 2004 (c) 2004 AE, CPM GmbH, Germany  

8th International Forging Conference/Brasil



Some ideas about simulation.....

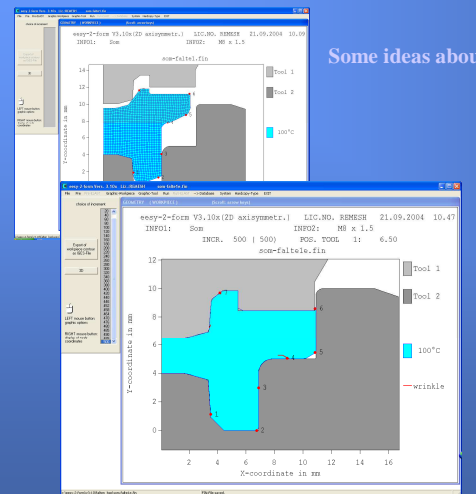
- Avoiding of failures
- Failure of a punch
- Bad pre-form design

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil



Some ideas about simulation.....

- Avoiding of failures
- Folding at the part surface

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



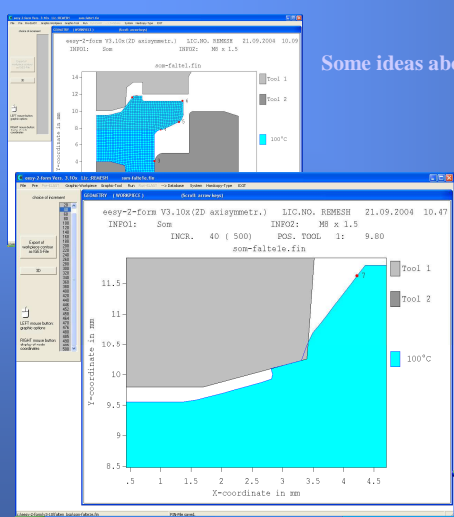
8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Folding at the part surface

Generation



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



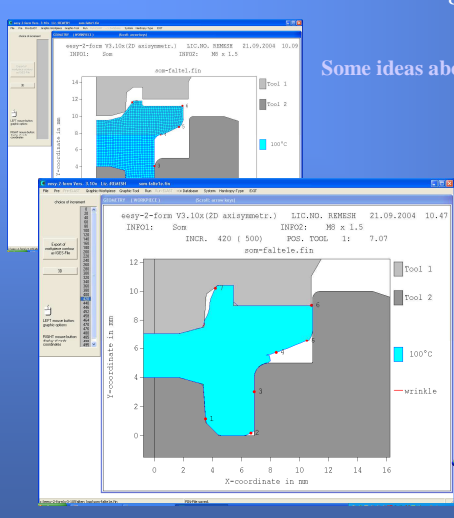
8th International Forging Conference/Brasil

Some ideas about simulation.....



- Avoiding of failures

Folding at the part Surface

Generation



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



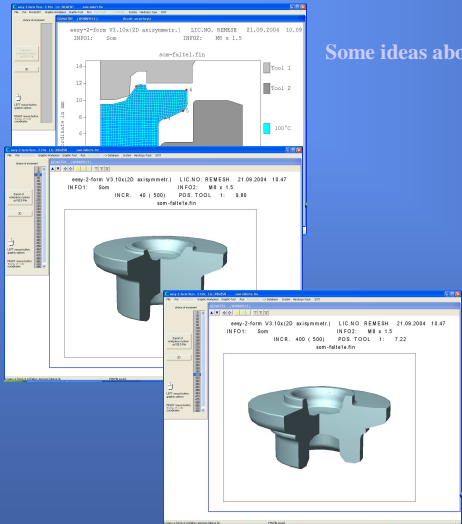
8th International Forging Conference/Brasil


Some ideas about simulation.....

- Avoiding of failures

Folding at the part Surface

Generation



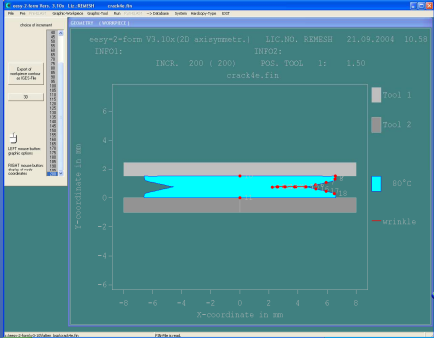
21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 


8th International Forging Conference/Brasil

Some ideas about simulation.....

- Avoiding of failures

Generation of a fold



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

8th International Forging Conference/Brasil

Some ideas about simulation.....

- Avoiding of failures

Splitting of a die due to high stresses



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

8th International Forging Conference/Brasil

Some ideas about simulation.....

- Avoiding of failures

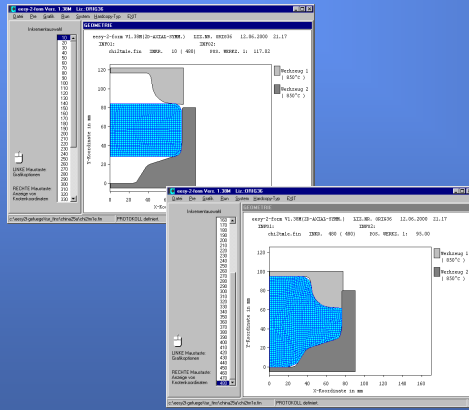
Splitting of a die due to high stresses



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

8th International Forging Conference/Brasil

Some ideas about simulation.....



- Prediction of microstructure
- Correct consideration of boundary conditions:
- Temperature
 - Machine
 - Material
 -



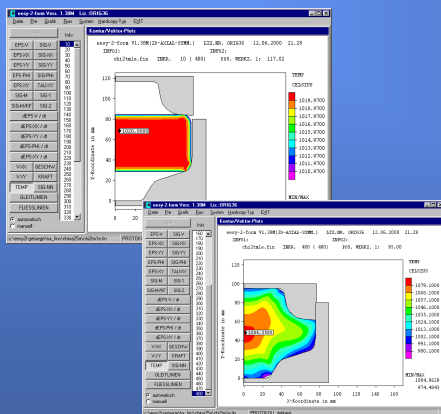
21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....



- Prediction of microstructure
- Correct consideration of boundary conditions:
- Temperature
 - Machine
 - Material
 -



21st of October 2004

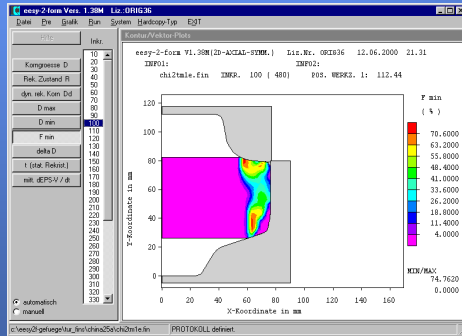
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- Prediction of microstructure
- Correct consideration of boundary conditions:
 - Temperature
 - Machine
 - Material
 -



21st of October 2004

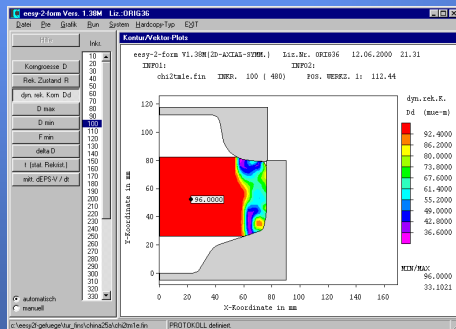
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- Prediction of microstructure
- Correct consideration of boundary conditions:
 - Temperature
 - Machine
 - Material
 -



21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



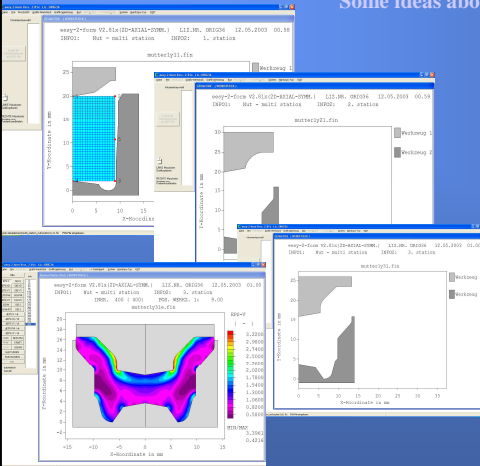
8th International Forging Conference/Brasil

Some ideas about simulation.....



- 3D or 2D ? What is the right choice?

Production of a nut

Automatic simulation of the multi-station process



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



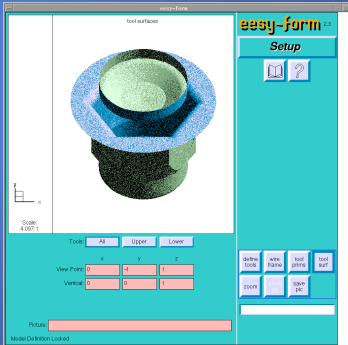
8th International Forging Conference/Brasil

Some ideas about simulation.....



- 3D or 2D ? What is the right choice?

Production of a nut

Tooling model in 3D



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany



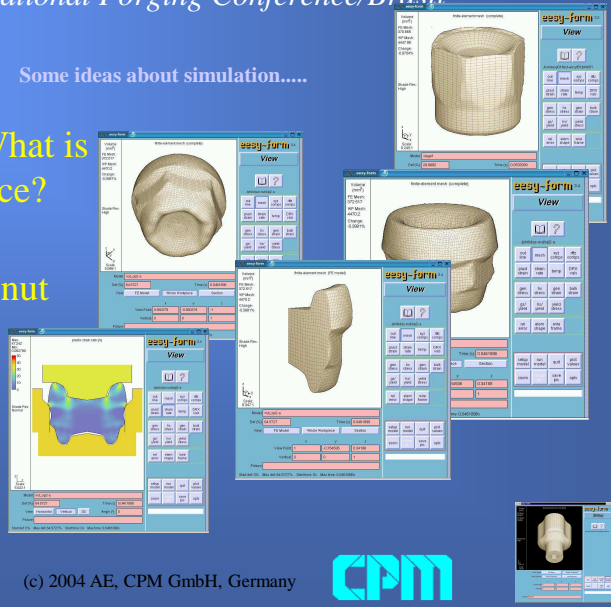
8th International Forging Conference/Brasil


Some ideas about simulation.....

- 3D or 2D ? What is the right choice?

Production of a nut

Simulation result 3D



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

8th International Forging Conference/Brasil

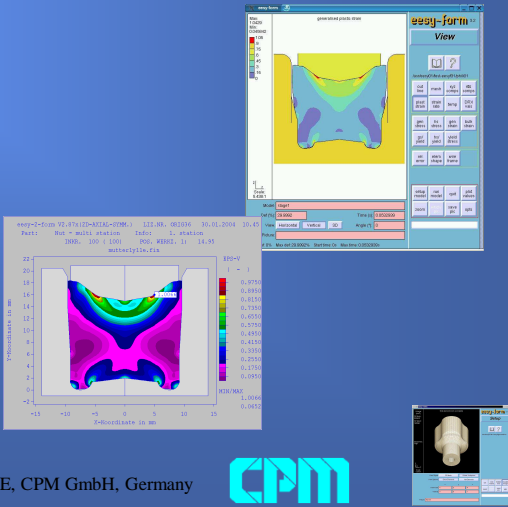
Some ideas about simulation.....


- 3D or 2D ? What is the right choice?

Production of a nut

Interpretation in cross sections

2D-3D



21st of October 2004 (c) 2004 AE, CPM GmbH, Germany 

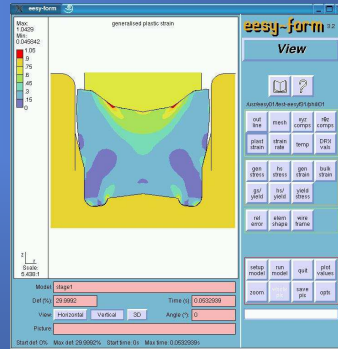
8th International Forging Conference/Brasil

Some ideas about simulation.....

- 3D or 2D ? What is the right choice?

Production of a nut

3D interpretation of strain in cross sections



21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



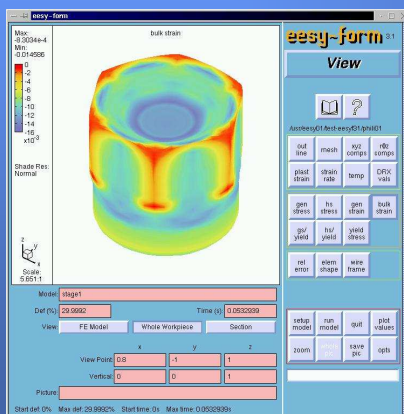
8th International Forging Conference/Brasil

Some ideas about simulation.....

- 3D or 2D ? What is the right choice?

Production of a nut

3 D interpretation of strain on the surface



21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- 3D or 2D ? What is the right choice?

Production of a nut

3 D geometry



21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



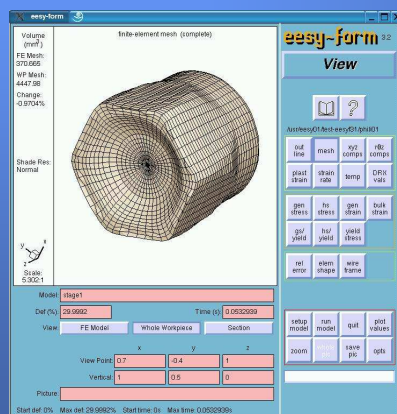
8th International Forging Conference/Brasil

Some ideas about simulation.....

- 3D or 2D ? What is the right choice?

Production of a nut

3 D geometry in simulation



21st of October 2004

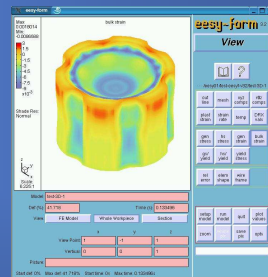
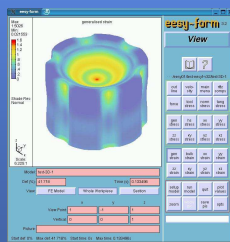
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- further 3D applications



21st of October 2004

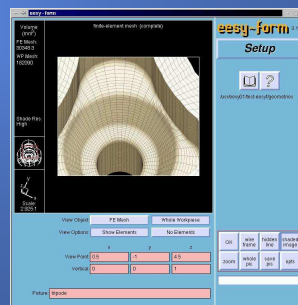
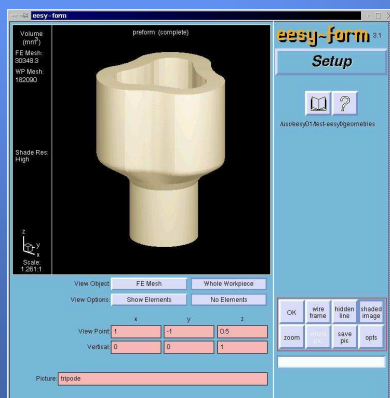
(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- further 3D applications



21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



8th International Forging Conference/Brasil

Some ideas about simulation.....

- Administration of data

EXCEL application
easy-archiv

Datename (*.FEM)	Anfangszustand	Endzustand	Datum	Kommentar / Bewertung	Werkstoff	Stauerdaten	weitere Angaben
cone_sha1fe	[Icon]	[Icon]	2001-09-05	INFO1: Cone Shaft INFO2: Hammer Forging (17 blows) Art der Rechnung - thermisch-mechanisch	2 4868, NiCr19 NiMo, 900-1150 [°C], 0.1-10 [t/sek] (c) CPM-MDZ	Hämmer geschmiedet mit Gasdruckförderung Schläge: 17	Ausgangsgeometrie: Durchmesser: 203,2 mm, Höhe: 230,3 mm, Fußtemperatur: keine
knit1dfe	[Icon]	[Icon]	2001-09-06	INFO1: INFO2: Art der Rechnung - mechanisch Umgebungsstemperatur: 0 °C	1.7023, 34 Cr4, 30-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.58000+03 mm	Ausgangsgeometrie (Verstärkt): Durchmesser: 7,8 mm, Höhe: 2,75 mm
steele_stamless_2e	[Icon]	[Icon]	2001-09-06	INFO1: INFO2: Art der Rechnung - mechanisch Umgebungsstemperatur: 50 °C	1.4567, X3 CrNiCu18 Ni9, 08-200 [°C], 0.1-10 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.11000+03 mm	Ausgangsgeometrie (Verstärkt): Durchmesser: 35,0 mm, Länge: 224,5 mm
steele-a-11e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	Abst. 111e Durchmesser: 35,0 mm
steele-a-21e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
steele-a-31e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
steele-a-41e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
hoeforge-tot1e	[Icon]	[Icon]	2001-07-19	INFO1: Hot forging INFO2: T=1100 °C, const Art der Rechnung - mechanisch Umgebungsstemperatur: 50 °C	unbekanntes Testmaterial bei 1100 [°C]	Kurbelstange max. Hub: 0.200000+03 mm	keine weiteren Angaben Anzahl Huebe

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany



Datename (*.FEM)	Anfangszustand	Endzustand	Datum	Kommentar / Bewertung	Werkstoff	Stauerdaten	weitere Angaben
cone_sha1fe	[Icon]	[Icon]	2001-09-05	INFO1: Cone Shaft INFO2: Hammer Forging (17 blows) Art der Rechnung - thermisch-mechanisch	2 4868, NiCr19 NiMo, 900-1150 [°C], 0.1-10 [t/sek] (c) CPM-MDZ	Hämmer geschmiedet mit Gasdruckförderung Schläge: 17	Ausgangsgeometrie: Durchmesser: 203,2 mm, Höhe: 230,3 mm, Fußtemperatur: keine
knit1dfe	[Icon]	[Icon]	2001-09-06	INFO1: INFO2: Art der Rechnung - mechanisch Umgebungsstemperatur: 0 °C	1.7023, 34 Cr4, 30-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.58000+03 mm	Ausgangsgeometrie (Verstärkt): Durchmesser: 7,8 mm, Höhe: 2,75 mm
steele_stamless_2e	[Icon]	[Icon]	2001-09-06	INFO1: INFO2: Art der Rechnung - mechanisch Umgebungsstemperatur: 50 °C	1.4567, X3 CrNiCu18 Ni9, 08-200 [°C], 0.1-10 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.11000+03 mm	Ausgangsgeometrie (Verstärkt): Durchmesser: 35,0 mm, Länge: 224,5 mm
steele-a-11e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	Abst. 111e Durchmesser: 35,0 mm
steele-a-21e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
steele-a-31e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
steele-a-41e	[Icon]	[Icon]	2001-09-06	INFO1: Aste INFO2: 4 station operation Art der Rechnung - mechanisch Umgebungsstemperatur: 25 °C	1.1172, Cq 35, 25-300 [t/sek] (c) CPM-MDZ	Kurbelstange max. Hub: 0.371000+03 mm	siehe steele-a-11e
hoeforge-tot1e	[Icon]	[Icon]	2001-07-19	INFO1: Hot forging INFO2: T=1100 °C, const Art der Rechnung - mechanisch Umgebungsstemperatur: 50 °C	unbekanntes Testmaterial bei 1100 [°C]	Kurbelstange max. Hub: 0.200000+03 mm	keine weiteren Angaben Anzahl Huebe

21st of October 2004

(c) 2004 AE, CPM GmbH, Germany

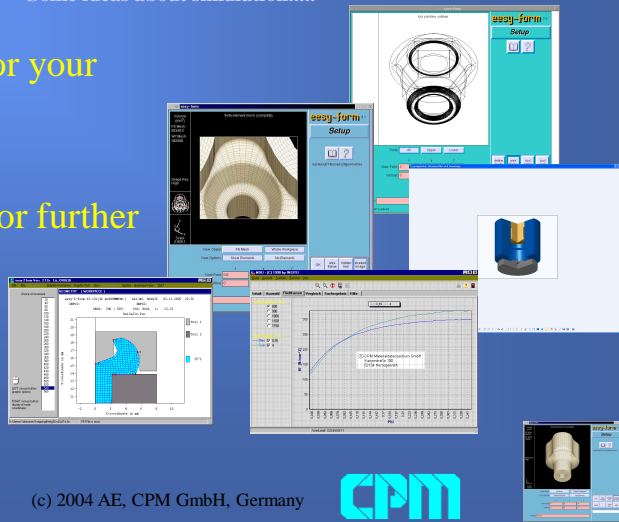


8th International Forging Conference/Brasil

Some ideas about simulation.....

- Thank you for your interest

Pls contact us for further information



21st of October 2004



(c) 2004 AE, CPM GmbH, Germany

