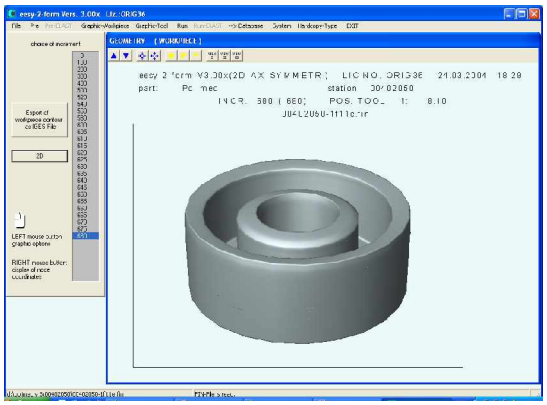

CPM comes to Taiwan

By G.H. Arfmann and Castle Chen *)

Cold Forging, Simulation technology, Engineering, Consulting, R&D

The article gives a short Introduction about CPM and shows applications of simulation in cold forging

Introduction

CPM Gesellschaft für Computeranwendung, Prozeß- und Materialtechnik GmbH (CPM) is an engineering company for forging technology founded in 1987. CPM is based in Herzogenrath, Germany.

The main focus of the business of CPM is in forging with the following topics:

- Consulting
- Process and product design optimization
- Development and sales of simulation software
- Introduction of new technologies
- material-data for simulation
- Research - and development-projects (participation, co-ordination)

CPM addresses companies providing forgings to car, aeronautics, furniture, medicine, construction and electronics industries. These companies may

produce fasteners or complex forgings. The process may be cold, warm or hot forging.

The aim of CPM is to help to develop new processes, to help to use of new materials or new production-procedures but also to optimize existing productions and to make new technologies available. The use of new materials and the corresponding technologies offers important future-chances for the industry.

CPM target with their offer small and medium size as well as big scale global businesses and commits itself however also in development-projects with large-scale enterprises and research-facilities.

In consequence of the globalization of the markets, CPM has commercial relations in the European market as well as in Asia, South and North America, India, Russia and the Middle East today.

Simulation

Simulation technology is one of the products offered by CPM.

This article will show applications from cold forging.

Using the simulation technology to develop and optimize processes before testing them in production offers a huge potential of cost saving. Costly production-attempts can be avoided.

Valve spring retainer [1)]

The first example deals with the production of a valve spring retainer. In this case an existing progression was used on a new machine and surprisingly the tooling was failing premature.

The following picture shows the progression.

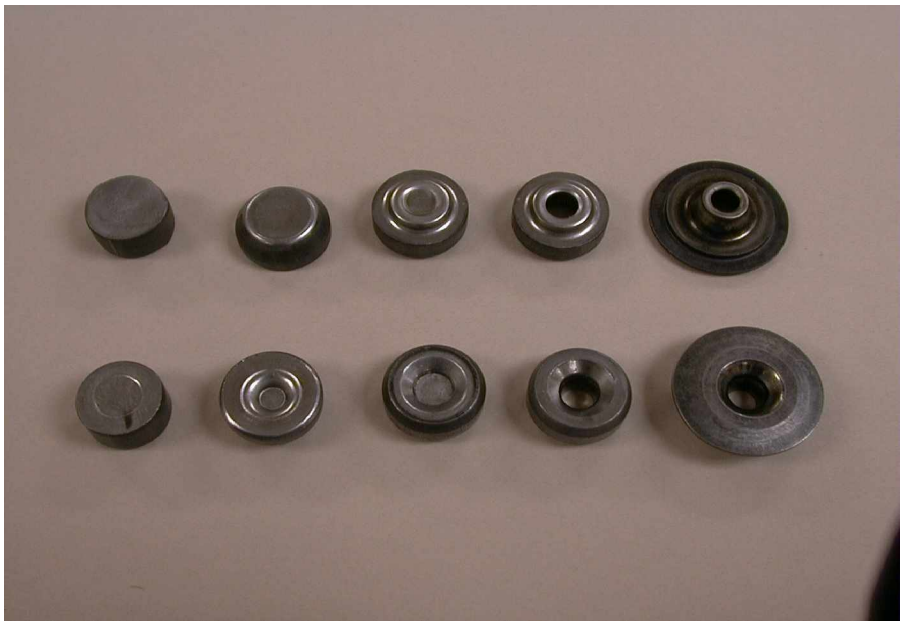

Fig.1: Progression to produce the retainer

The punch to form the conical shape in operation five was failing after a few thousand pieces.

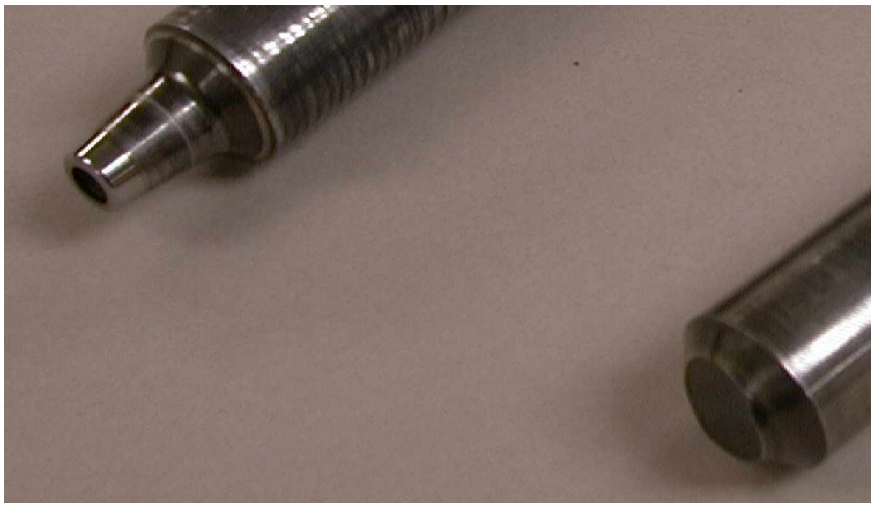

Fig.2: Failing punch

The Finite Element Analysis (FEA) showed positive axial tresses in the punch during the operation exactly at the position where the punch failed.

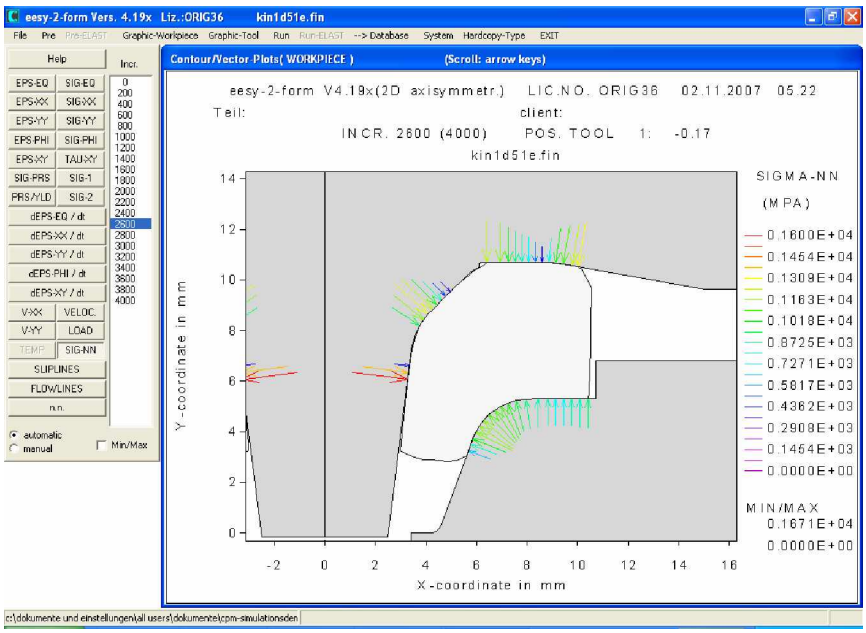

Fig.3: Pressure distribution on punch surface

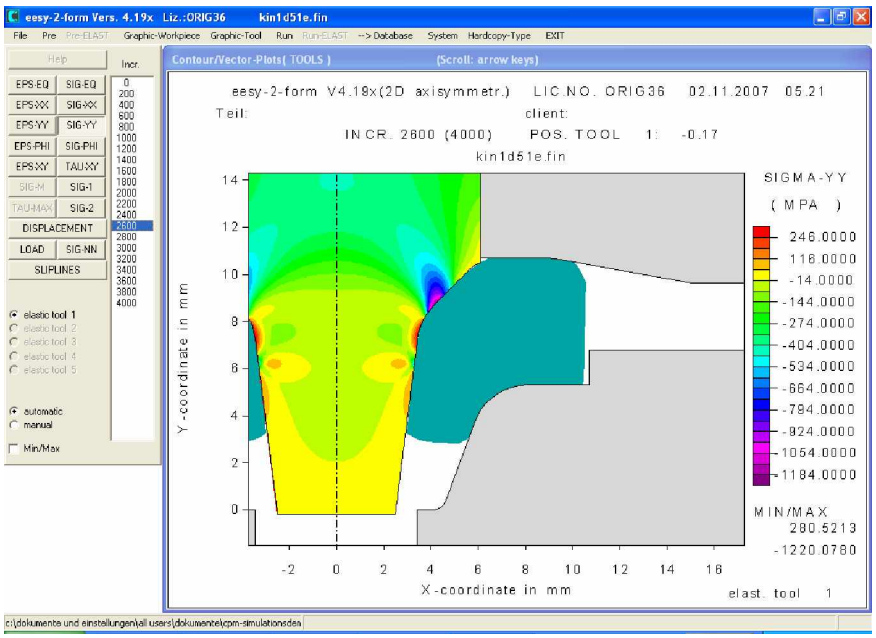

Fig.4: Positive stress in the punch

Studying the process more in detail it could be seen that to the end of the operation this positive stress disappeared due to material contact in the die which lead to a better stress distribution on the punch.

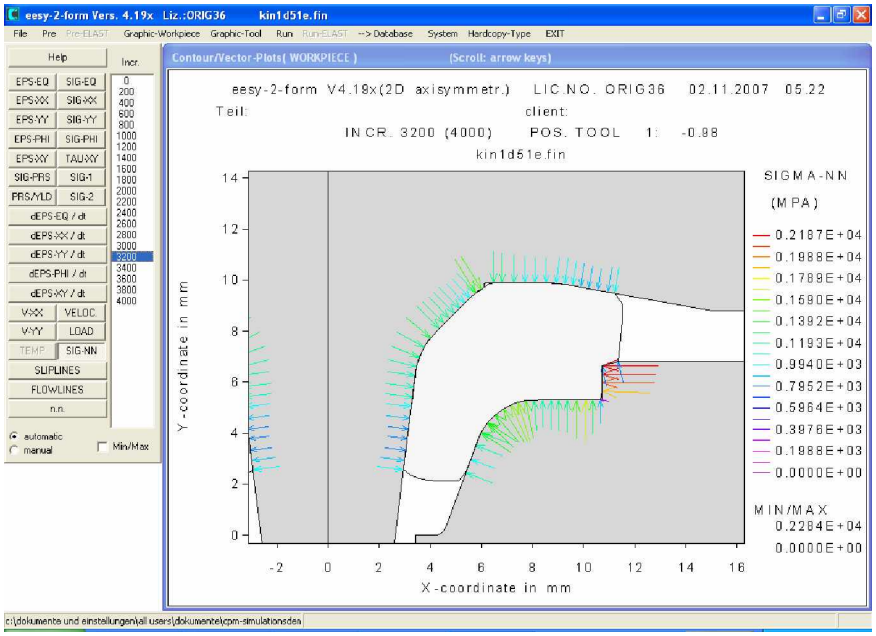

Fig.5: Pressure distribution on punch surface while Material is in contact on the die corner

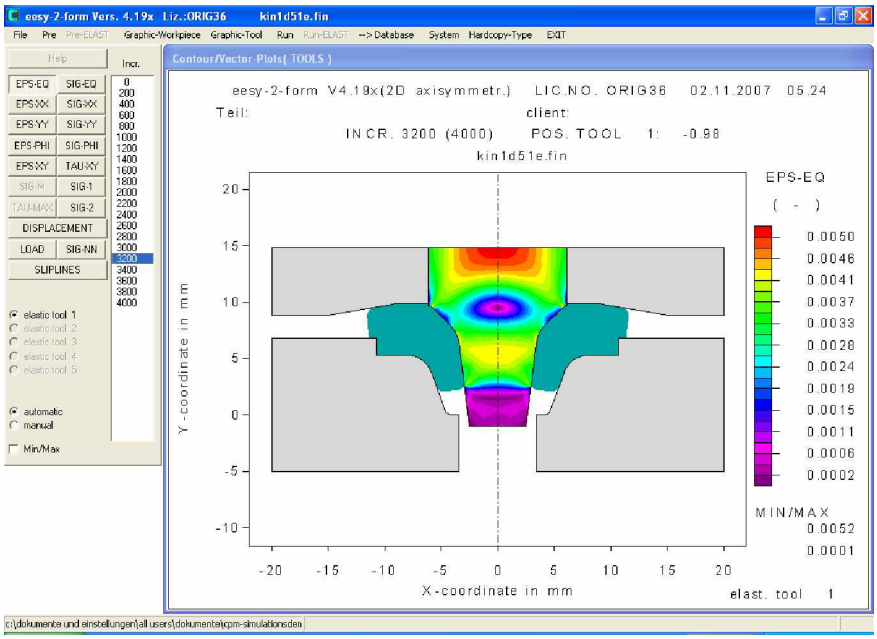

Fig.6: Stress situation in the punch while Material is in contact on the die corner

The engineering solution was to enlarge the piece diameter in operation three to get better contact conditions in the die in operation five. With this change the tool life could be increased about 10 times.

Inner Race [2)]

The second example is about the production of an inner race.

Simulation was performed to find out about the material flow before the tooling was designed. The simulation showed folding of the material und under filling.

By varying the cut off and the perform a better design could be reached which allowed then for a good filling

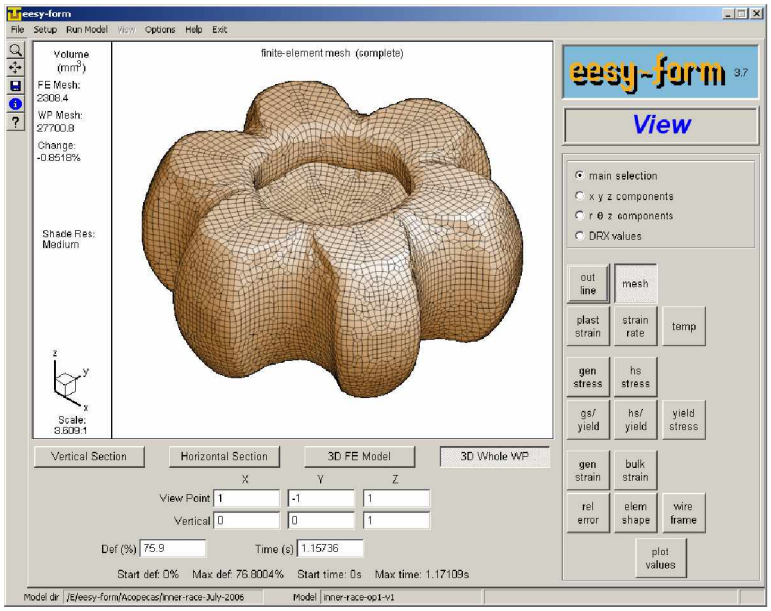

Fig.7: Fold inside the inner race (3D view)

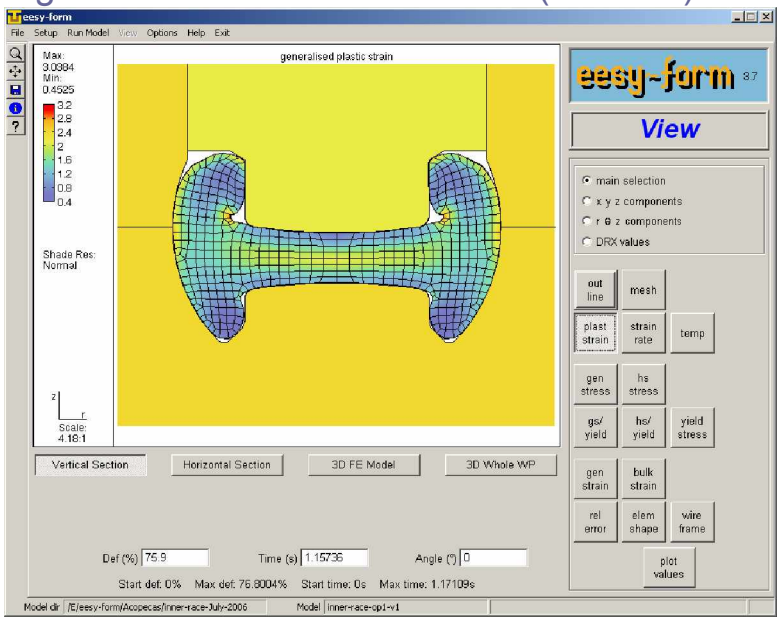

Fig.8: Fold inside the inner race (2D cut)

Nut

A third example shows the analysis of a nut making process.

In the fourth operation some folding occurred.

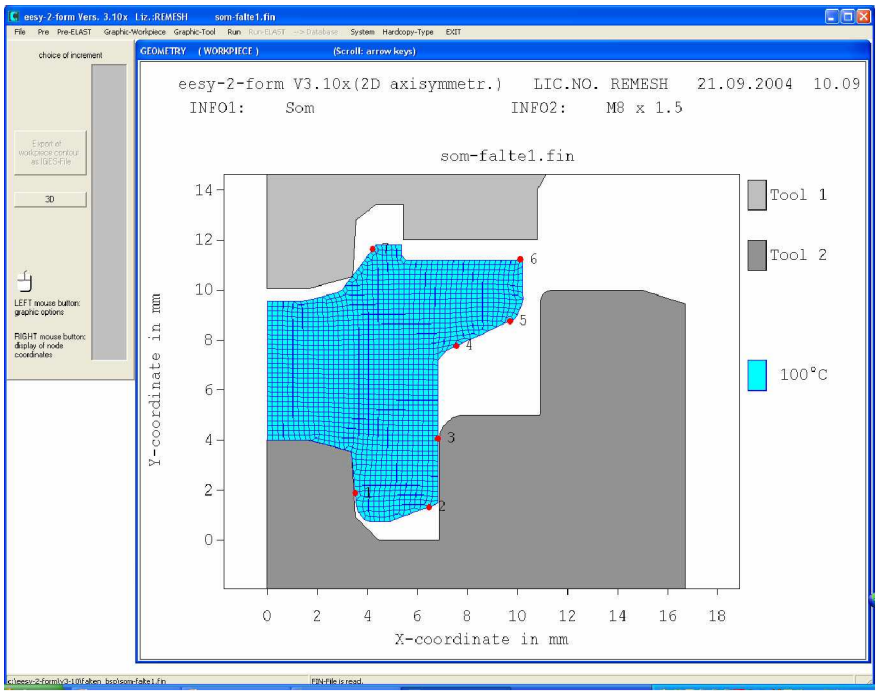

Fig.9: Initial situation in operation four

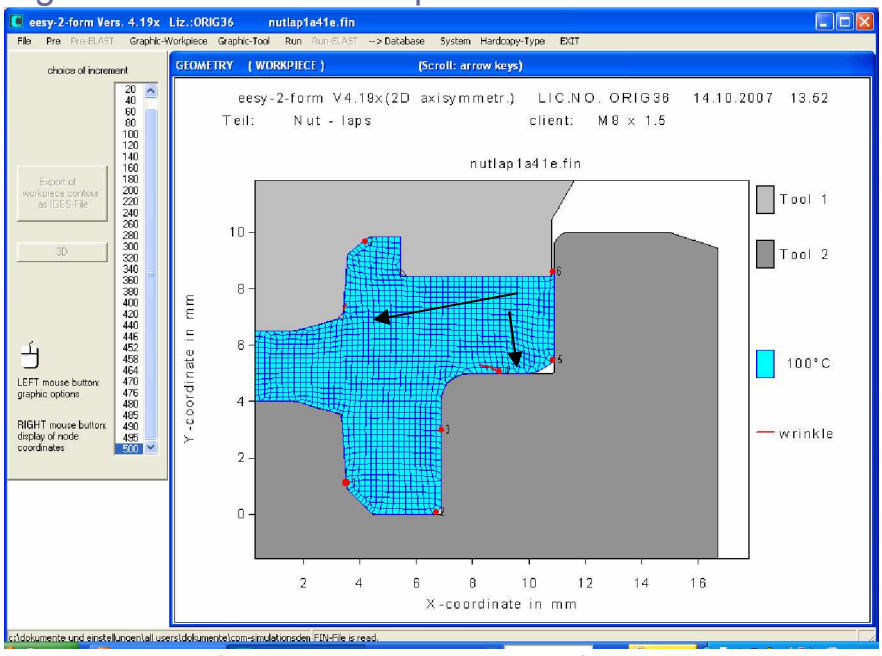

Fig.10:Final Situation showing the folding

One of the detected folds would have had a severe influence on the tool five in making the thread. The other one would have been unacceptable at all.

Using the results of the simulation the process could be re-designed and the folding could be avoided.

Summary

Most of the daily problems in design of a metal forming process can be supported by today simulation technology.

Some special applications need further development still.

Simulation is generally established as a design tool.

Hurry up to not miss the train ..

But choose your simulation partner carefully ……

he has to be expert in forging as well!

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1) G.H. Arfmann, M. Twickler, M. Corbet,;
Kaltumformung eines Ventilfedertellers
Prozeßoptimierung mit Hilfe der FEM – Simulation
MM, Germany, 2001

2) P. Schmid, G.H. Arfmann
Production of an inner Race
Acopecas, Brusque, Brazil, 2006, unpublished

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