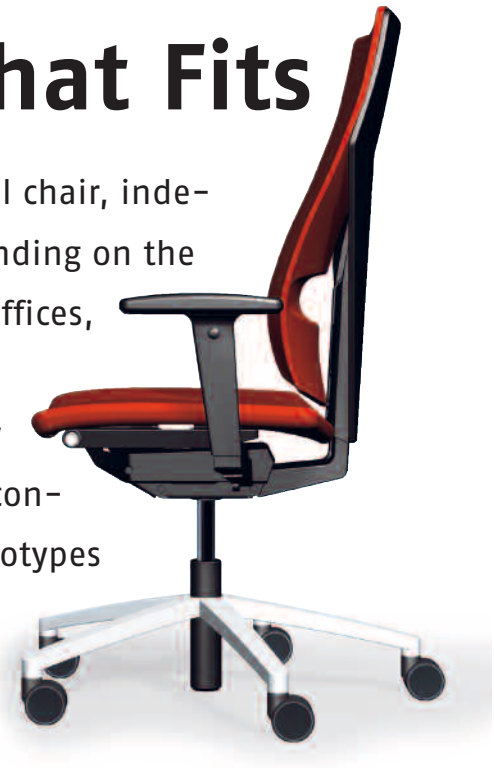
A Concept that Fits

Development Project. „Signeta", a new office swivel chair, independently adjusts the optimal seating position depending on the „owner's" weight. Furniture manufacturers, design offices, mould manufacturers and injection moulders have co-operated intensively for a whole year to make the design, construction, FEM computations, prototypes and the large scale moulds for the individual components of the comfort furniture finally co-ordinate with one another and to produce them.



Presented in October at the trade fair Orgatec in Cologne/Germany: the office chair „Signeta" embodies several constructional innovations. The „Intelligent Control System" balances the weight and the proportions of the user over the backrest, the conventional upholstered seat plate was replaced by a pre-stressed fabric and the back lordosis adjustment was solved with a three-dimensional ductile back cushion. (photos: König + Neurath)

THOMAS TOSSE

An increasing number of enterprises turns to flexible employment structures, e. g. consultant jobs, job-sharing or flexible office concepts. They require special forms of office organisation. Therefore König + Neurath have developed a new office swivel chair, Signeta, based on the „i-seating" philosophy.

The designer piece adjusts itself by means of innovative mechanics, the „Intelligent Control System", to the actual weight and proportions of the user, so that he/she spontaneously sits ergonomically correctly. This philosophy was tested with newly developed mechanics and different modified backrests. Tall thin people apply a different leverage force than small heavy ones – however, the body weight should result in the same counteracting force. The backrest must adapt ergonomically, just as the seat surface, whose front edge must not press into the thighs. In addition the fulcrums must be selected carefully. These tests as well as the development of the kinetics and the patent application were important steps before the project came to the actual implementation phase. „The joy of experimentation and a broad wealth of experience are the best tools at this stage", opines Franz Tschacha, Managing Director at the mould builder Deckerform GmbH.

Built in Ergonomics

Additionally the office chair should be equipped with a new lordosis height adjustment, which in each case forms the entire s-shaped back outline more strongly or more weakly: „The special way of covering a solid framework should provide for optimal adjustment to different back shapes", says Thomas Fehr, Manager of technology and production at König + Neurath. The conventional upholstery was therefore replaced by a flexible support upholstery construction, which is arranged in three horizontal areas. They are connected by film hinges on the side edges. From the side the seat-back bowl has an S-arch which can be changed with these film hinges. At the end of a test series the material polyamide was selected because of its good resetting characteristics in the hinges and the flexibility and the transverse forces of the covering were adjusted in such a way that optimal sitting is ensured for all body sizes and weights.

„With a FEM computation the geometry of the hinge could be dimensioned and designed for the series requirements although the direction of motion and load direction are not in the same plane" explains the simulation expert and customer advisor Peter Ottillinger from Deckerform. Because of many years of accumulated empirical values the mould construction enterprise is a recognised partner in the European office chair industry – also in product development. With this project the fact that Ito Design and Deckerform had already completed a forerunner project concerning a flexible back bowl successfully together with König + Neurath paid off. „The parts serve their purposes without expensive changes in the moulds being necessary, which otherwise would have become expensive", declares Nikolaus Heidt, Design Manager for the specialist area of office chairs with König + Neurath, who could

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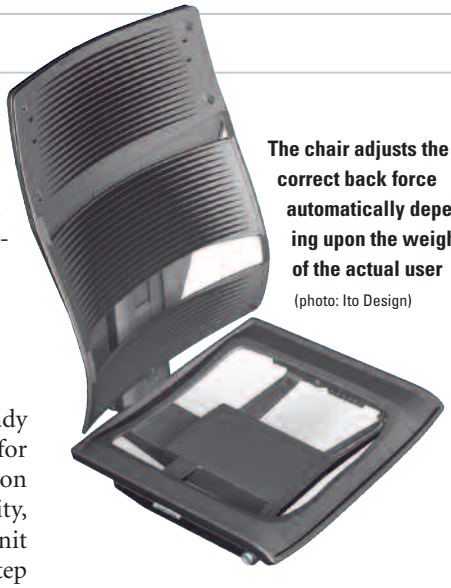
rely on the partners Deckerform and Owi GmbH concerning all technical questions about plastics, design and FEM computation as well as mould engineering.

Project Groups Co-operate from the Outset

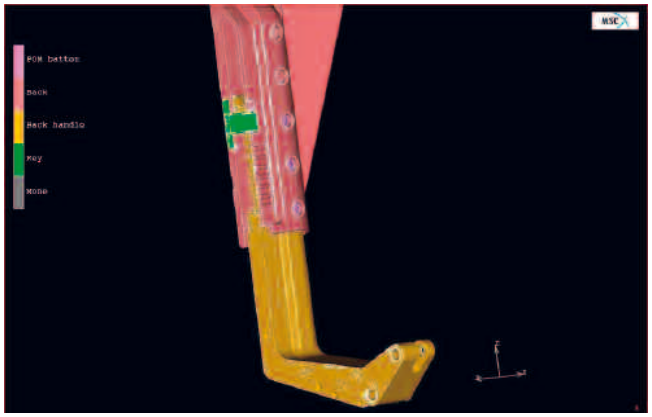
The plastic processing plant Owi already examined the first design suggestion for the technical practicability of its injection moulding. The material, surface quality, sunk spots as well as construction unit distortion were defined. In the next step the mould builders brought in their knowledge: the possibilities of release from form, the necessary mould release bevels and the dividing line process for view parts resulted in a sustainable mould concept. Peter Ottillinger: „For a fluid cost optimised project sequence it is crucial that the mould technology be considered as early as possible. Thus error development with high change costs can be avoided. Further, the required short development time could be met only with this procedure."



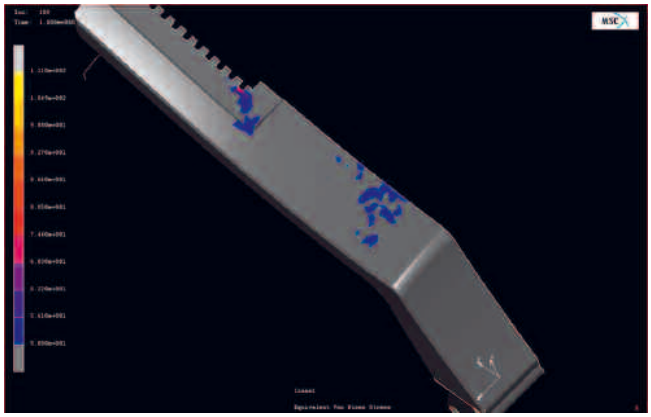
The chair adjusts the correct back force automatically depending upon the weight of the actual user (photo: Ito Design)

It is just as important to safeguard the design with FEM computations. For that Deckerform modified the first 3D-CAD data records and prepared for the computations. In this case two complete assemblies with the seat and backrest components were to be investigated. „Only when the entire assembly is considered are realistic results obtained because thereby all motion paths and deformations are included", Ottillinger knows. The deformation values permit valuable conclusions on the ergonomics; the tension and torsion values show whether the selected material can enduringly withstand future loads. In each case the back handle made in a mono-sandwich structure, the back carrying bowl and the release key were loaded in lower and upper positions. In the first iteration loops the evaluation indicated areas where the permissible stress in the planned polyamide PA-GF 15 reinforced with 15 % strengthened glass fibres was exceeded. After the third optimisation loop, in which the wall thicknesses and construction unit geometry were changed in the context of the given design, is was sure that all components would withstand the forces and the chair shows the dynamics that promotes ergonomic sitting.

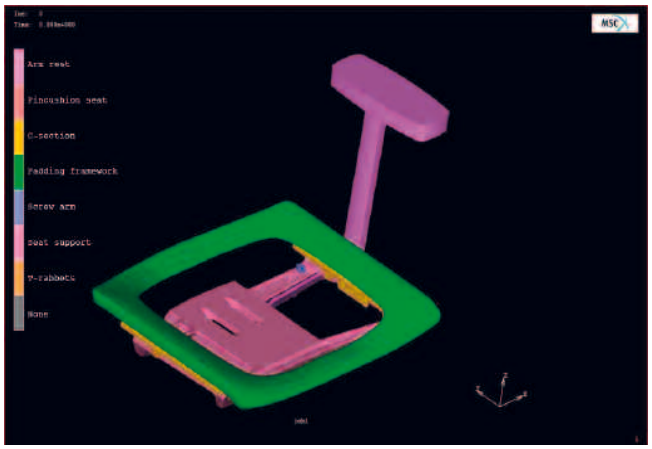
Precisely investigation of the seat assembly safeguarded two further innovations of the office chair. The seat support was not made by aluminium die casting, but using the injection moulding process with PA-GF 30. A seat framework was designed at the same time, which when provided with a pre-stressed net fabric makes possible substantially better seat comfort than the conventional solid plates. How-



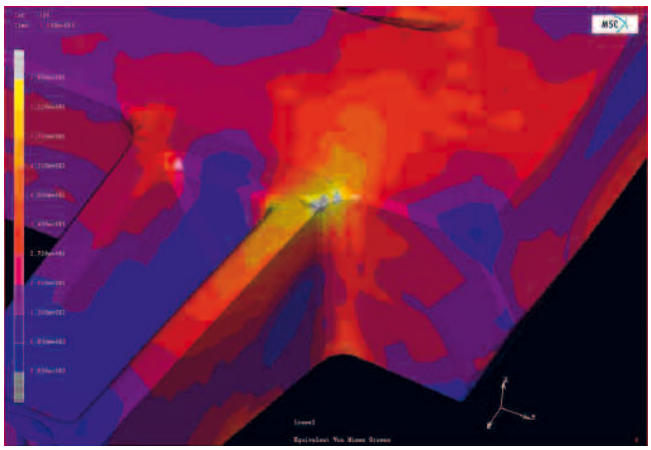
The back assembly in the FEM computation (picture: Ito Design)



The coloured areas of the back carrier exceed the permissible stress for PA-GF 15 in the first computation (picture: Deckerform)



The seat assembly consists of a seat support, a seat framework and an arm rest and in addition, rolls, screws and profiles as well as the stretched fabric (picture: Ito Design)



Work on details: after force application through the arm rests the peak stress is removed by reduced core removal (picture: Deckerform)

The mould for forming the seat support part during the final inspection on the touch up press (photo: Deckerform)

At Owi in Lohr am Main/Germany the first components of the backrest already come off the line (photo: Owi)

ever, the seat framework is thereby subjected to a continuous stress, which in advance could only be measured badly. After definition of the junction points of the individual chair parts among themselves - here fixed connections and screw connections or bonding and contact connections are distinguished, which can separate under the loads - the extreme positions of the sliding seat function had to be examined in each case for force application from the front and from the back. Again three approximation steps were necessary. Above all the seat support was designed more rigidly than originally planned. After further investigations of force application on the arm rests it was possible to clearly increase the stability of the construction with stronger roundings and reduced core removal. „The cross sections of the seat support were dimensioned in the approximation steps of the FEM computation and changed so that we nevertheless succeeded in continuing to use the design", reports Peter Ottillinger.

High-quality Components despite Deadline Pressure

Also Bernd Köhler, Head of the specialist area plastics in the Owi company, is pleased about this progress. „The use of glass-fibre and glass-ball reinforced polyamide compounds in two-component injection moulding has made it possible to replace the die cast aluminium parts for the seat and back carriers." Without use of a propellant thick-walled parts like the seat framework could not be manufactured economically, because alternatively the feared sunk areas could be reduced only with extremely long cooling periods and long afterpressure times across very large dead heads. The material and form of the flexible lordosis cushion carrier had to be co-ordinated exactly in order to achieve high seat comfort. The back carrying bowl, a wide, height adjustable visible part made of glass fibre-filled polyamide, implies special requests concerning design and surface quality. „That succeeded really well and looks very clean", praises Nikolaus Heidt, Head of design for the specialist area of office chairs with König + Neurath. That is no miracle: Owi, a specialist in high-quality parts and complex injection moulding technology, has already worked for ten years for König + Neurath, among others, with the current project partners.

The project time of one year, in which those involved convened in coordination rounds a half dozen times, became particularly limited toward the end: the mould maker had to deliver in record time. The mould concepts were already provided, the dimensions and alloys of the future mould steels fixed as well as the steel to be used for the mould plates, although the component to be manufactured with these moulds was still not at all completely developed. That was lively simultaneous engineering!

Under the high deadline pressure it particularly benefited the customer that Owi, due to its medium-size and flexibility and its domestic location, could carry out discharges a short notice when this became necessary. Thus up to the late shift at Deckerform final optimisations and function tests were still carried out and the moulds shipped at night with the works lorry to Owi, so that on the following morning the first injection moulded parts could already be produced. The project engineers from König + Neurath were present at the inspections and could evaluate the part functions and the quality of the injection moulded parts in first judgments. A process that would often need weeks in a global procurement. „In the end we succeeded in landing exactly where we had planned", summarises Bernd Köhler, „both for the high-quality part design with top surfaces and economic material use and for the cycle times." Thus the intelligent office chair „Signeta" became even a little more inexpensive than the original calculations. ■

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