

Modeling and Manufacturing of Cranium Implant

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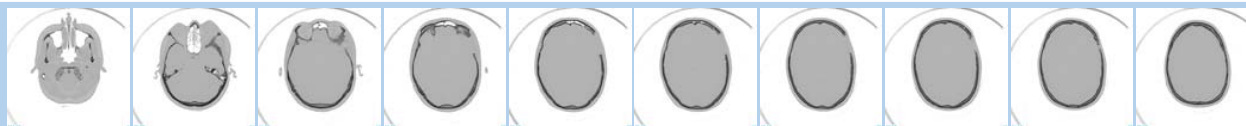
Akian College of Science and Engineering

Software: Mimics, Solidworks, SURFCAM Year: 2007

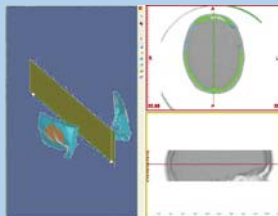
Introduction

The goal of this project was to design and manufacture a master model for a cranium implant based on the CT data of a patient. The motivation for this project was the fact that despite good traditions in orthopedic, maxillofacial, and neuro-surgery, and the existence of many skilled specialists in these areas, medics in Armenia still use old technologies in their practice. Thus, the project aimed at showing some advanced engineering approaches in the field. With this idea, we organized a seminar and invited neuro- and maxillofacial surgeons. This was also our students' initiative who wanted to know some medical nuances of the problem. It was a very interesting discussion, as the medics discovered what techniques they use while dealing with such cases, and we presented the results of the project to them.

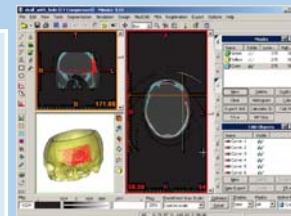
From Mimics to Solidworks, From Solidworks to SURFCAM



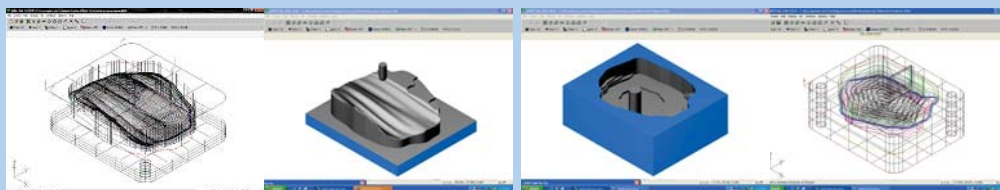
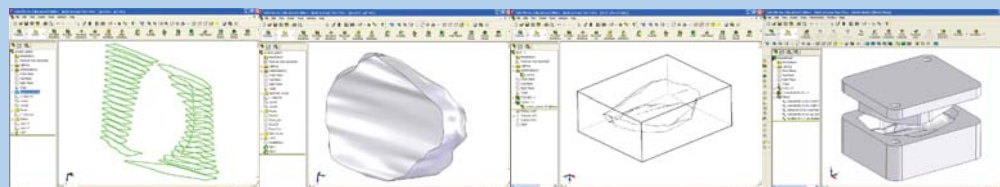
CT images of the damaged skull



The left picture shows our first modeling attempt, which was based on mirroring the portion of the skull from the intact left side to the right and filling the hole using Boolean operations. After realizing how asymmetric our skull can be and that we will not need so much detail including all the small cavities and protuberances, we proceeded with the second approach shown on the right picture. We used the axial views of the images and created spline curves representing the sections of the skull and the hole in 20 layers. The set of these curves was saved as an IGES file to translate to SolidWorks.

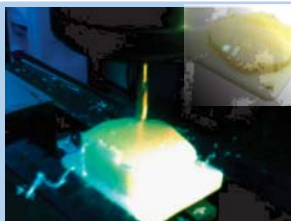


To get the master model of the implant, we used the curves representing the boundaries of the damaged skull (see the first picture). By blending them together we got the solid model of the implant (see the second picture). Then, we put the implant within a box and subtracted it from the box (see the third picture). Thus we got a cavity within the box. Finally, we split the box into mold pieces (see the last picture).



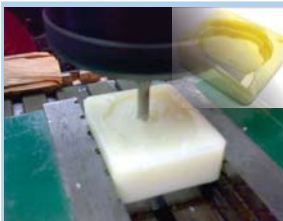
The separated mold pieces were transferred into SURFCAM through IGES conversion. Here, we generated tool paths, verified the machining processes, and obtained numerical control programs.

Result and Post-Project Fun



Picture on the right: Machining the lower piece and the result of the process (in the upper right corner).

Picture on the left: Machining the upper piece and the result of the process (in the upper right corner).



Mold pieces and what is extracted out of the mold. The implant (red one) is made of bio-compatible medical material polymethylmethacrylate (PMMA).



Picture on the left:

Puzzle: Guess who is who?
Tatev hasn't taken the course.
Arpine has already finished her part.
Armineh's part is now being machined.

Pictures on the right:

Post-project collages by the project team.

