



# Reconstructing Faces

A new application of mathematics allows surgeons to plan reconstructive facial surgery by analyzing various operative strategies implemented on virtual three-dimensional models. Previously, replicas constructed from CT-scans were used, which were expensive and allowed only one surgical strategy per replica. The new virtual models use geometry, partial differential equations, and numerical analysis to represent the movement of bone and soft tissue associated with different options, so that surgeons and their patients see the predicted results and choose what's best.

Three-dimensional simulations of facial surgery involve grids with hundreds of thousands of tetrahedrons to compute the predicted outcomes of relocating bone and its influence on connecting tissue. The accuracy of the simulations, within one millimeter of actual results, allows them to be used both as teaching tools and as platforms for testing new techniques. Thus, mathematical modeling is improving the outlook for today's patients and for future patients as well.

For More Information: "Mathematics in Facial Surgery," Peter Deuffhard, Martin Weiser, and Stefan Zachow, *Notices of the American Mathematical Society*, October 2006.

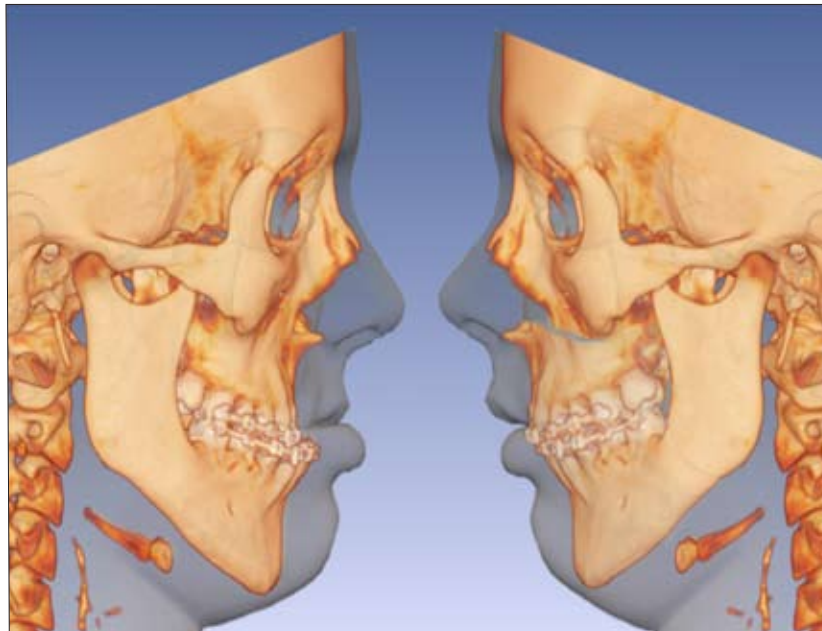


Image: A patient pre-operatively (left, reconstructed from tomographic data) and post-operatively (right, simulated), courtesy of Stefan Zachow, Zuse-Institute Berlin (ZIB).



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