Optimization of Sheet Metal Products with Branches of a Higher Order

Dr. Armin Fügenschuh*

Date 14.12.2005, Time 12:15, Room: 234

Abstract. In this talk we will introduce the subject of the Collaborative Research Center SFB-666. Located mainly in the mechanical engineering, it also has ties to mathematical optimization.

The new sheet metal forming process "linear flow splitting" provides the opportunity to form branched profiles in an integral style out of a single sheet of metal.

Figure 1: Process principle and produced simple geometry.

However, each additional branch leads to new possibilities for the topology and the geometry of the product. Manufacturing constraints also have to be taken into account. Handling the amount of producible profile variants thus requires a methodical procedure.

Because of the high complexity, we split the entire procedure into three subproblems: 1) the generation of an optimal topology, 2) the refinement of the geometry, and 3) an incorporation of the production constraints. The output of one step is thereby taken as input for the next one. In each of the three steps, different mathematical modeling and solution techniques are used. For the topology generation, we use linear mixed-integer programming. The geometry refinement is based on non-linear optimization. Finally, the production constraints can be transformed to a certain graph-theoretical problem.

We present these models and computational results for small test instances.

*Working Group *Discrete Optimization*, Faculty of Mathematics, Darmstadt University of Technology, Schlossgartenstraße 7, D-64289 Darmstadt, Germany.