FE Simulation of Laser Assisted Bending

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Abstract. Steel has a long tradition and is used in nearly every application. In order to be able to compete with other lightweight materials over and over again new steel grades are developed. Interesting steel grades, which are especially suitable for the lightweight construction in the automotive industry, are the multi-phase steels. Multi-phase steels reach already yield strengths over 1000 MPa. This is a challenge for the production engineering. Drawing, forming and cutting tools must be stiff and hard and/or coated, lubricants have to decrease friction to avoid damages induced by the high surface pressures. The designers have to consider the small forming capability by large radii or reduced drawing depths. To overcome these disadvantages new, innovative forming processes, e.g. laser assisted bending or roll forming, have to be developed. In the forming technique it is known that the forming limits can be increased by warm forming. But the conventional heating systems may cause unwanted changes of the material regarding to the structure and the mechanical properties. In the case of multi-phase steels e.g. the hard phases martensite and bainit can be transformed into ferrite and therefore the yield stresses can be changed clearly. In contrast to this laser assisted bending minimizes structural changes due to the local heating of the forming area. Beside the advantage, that only a small area of the bending part is exposed with a thermal load, the heating up with the laser permits high heating rates and also a controlling of the heating and cooling rates, so that the heating and cooling can be adapted to the material and its properties. In the context of this paper parameter studies with FE simulations of the laser assisted bending process are presented.