

## Feasibility and parametrical study of an incremental sheet bending process using a finite element model

Said Ballouch<sup>1</sup>, Mohamed Elamine Ait Ali<sup>1</sup>, Dominique Guines<sup>2</sup>

<sup>1</sup> University Mohammed V of Rabat, Ecole Mohammadia d'Ingénieurs, ERG2, Morocco

<sup>2</sup> Université Européenne de Bretagne, INSA de Rennes Rennes, LGCGM, France  
aitali@emi.ac.ma

**Abstract.** Metal sheet air-bending is a well-established forming process heavily used in different industrial sectors. It relies basically on a punch and a die with a v-opening that have a specific depth for each bending angle and radius. Which induces a high-cost tooling, reduces the process's flexibility and make it suitable only for mass production. For medium or low quantity production more flexible forming processes are needed. In this work we evaluate the feasibility of incremental sheet bending. Where a hemispherical tool follows a trajectory to bend the sheet. Will the bending angle be uniform? How is this uniformity affected by the sheet's width and the trajectory parameters? To answer these questions, we conduct a parametrical study using a finite element model of bending of simply supported sheet and the tool follows a sinusoidal trajectory. We develop a procedure to measure the resulting bending angle and its uniformity. We increase the sheet's width and for each value we change the trajectory's spatial period. We obtain a good uniformity for small spatial periods and it decreases for larger values. We quantify springback variation with these two parameters. These results give a good evaluation of the feasibility of the process, shows the effect of the sheet's width and the trajectory's spatial period on the bending angle and its uniformity. This process is an alternative flexible bending process for low and medium productions. The results help the designer in choosing the right parameters to have a uniform bending angle.

**Keywords:** incremental sheet bending, air-bending alternative, bending angle control

---