# EXPERIMENTAL AND NUMERICAL DETERMINATION OF THE TENSILE STRESSES IN THE WALL DURING STEEL SHEET IRONING

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ABSTRACT

This paper is dealing with analysis of the ironing process, by application of the experimental modeling and numerical FE simulations. Since the two approaches are complementary, abundance of obtained results enables overall analysis of the process with taking into account numerous influential factors and their interactions on the output process performances ad the quality of the machined piece.

Experimentally obtained results were confirmed by numerical FE analysis, which were realized at the same levels of the influential factors, for the purpose of verification and additional explaining of the process nature, as well as understanding the influence of various parameters on the machined piece wall tensile stress in the selected experiments.

KEYWORDS: Ironing, Wall stress, Tribology conditions, Tribo-modeling, FE numerical simulation

## 1. INTRODUCTION

Friction forces that act on the external and internal part of the element have different directions during ironing. The friction forces senses are opposite because the piece is moving through the die during drawing, and thus the friction force at the external surface has the sense opposite of the drawing. At the same time, at the expense of ironing, the piece is being extended, thus the friction force at the internal surface of the piece will be directed in the sense of drawing (Figure 1). Force $F_w$, which acts on the bottom of the piece, causes the appearance of the tensile stresses in the machined piece wall, both in the drawn portion and in the deformation zone. Those tensile stresses have the maximal value at the exit of the machined piece from the die and they are decreasing to certain minimal value, which they have at the entrance of the machined piece in the deformation zone /1/.

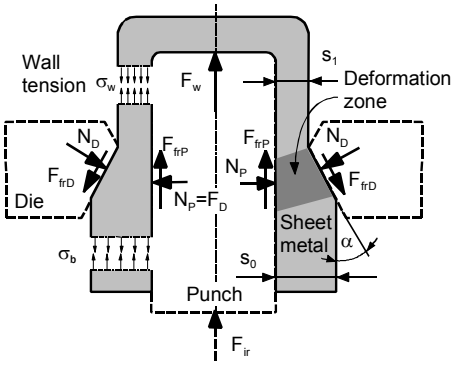


**Figure 1**: Scheme of the forces action on the thin sheet.