# Determination of fracture initiation of cut surface for punching press process using ductile fracture criteria

Phyo Wai Myint <sup>1</sup>, \*†Seiya Hagihara <sup>2</sup>, Toru Tanaka <sup>3</sup>, Shinya Taketomi <sup>2</sup>

## and Yuichi Tadano<sup>2</sup>

<sup>1</sup> Graduate School of Science and Engineering, Saga University, Japan.
<sup>2</sup> Department of Mechanical Engineering, Saga University, Japan.
<sup>3</sup> Industry Technology Center of Saga, Japan

\*Presenting author: hagihara@me.saga-u.ac.jp †Corresponding author: hagihara@me.saga-u.ac.jp

### Abstract

Punching press processes are useful processes for producing a lot of kinds of mechanical components such as automobile parts and other parts. In the punching press process using a punch and a die, a sheared surface and a fractured surface are usually formed on the cut surface. To produce more accurate parts which have small fractured surfaces, it is important to estimate the ratio of the sheared surface to the cut surface before making a punch and a die. Punching conditions such as clearance must be selected within the limits of cost constraints because higher precision punches and dies are needed for small clearance. The finite element method (FEM) has been applied to analyze the ratio of the sheared surface to the fractured surface along the cut surfaces. For this purpose, many researchers have used ductile fracture criteria for the fracture initiation of the cut surface. However, it is difficult to determine the fracture criteria on the cut surface by tensile tests or bending tests because the punching process involves many complicated steps. In this study, FEM is applied to calculate the ductile fracture criteria for the punching process proposed by Cockcroft and Latham [1], Oyane [2]. The ductile fracture criteria were compared with the boundary between the shear surface and the fracture surfaces using experimental results performed with a simple punching system. The values of ductile fracture criteria for the fracture initiation of the cut surface were predicted under various clearances between the punch and the die with various punch diameters

## Keywords: Punching press process, Fracture initiation, Ductile fracture criteria

#### References

- [1] Cockcroft, M.G., Latham, D.J., Ductility and the workability of metals, Journal of the Institute of Metals, **96** (1968), 33-39.
- [2] Oyane, M., Sato, T., Okimoto, Kunio., Shima, S., Criteria for ductile fracture and their applications, Journal of Mechanical Working Technology, **4** (1980), 65-81.