Topics

A New Trial on Incremental Forming of Sheet Metal Parts

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The various needs of customers in the automotive industries have created a recent trend in metal parts production toward the small production of a variety of parts at lower cost and with a shorter delivery period. As a method to meet these needs, incremental forming is demanded and has been actively studied, in which the parts are formed by a series of local deformations using general-purpose tools, for forming the parts produced in a small quantity. The incremental forming technique includes, for example, moving cylindrical tools along the parts shape and pressing or hammering the sheet metal blank using general-purpose tools[1)-3)].

For automobile sheet metal parts, backward stretch forming would be the most suitable because it can easily form complicated shapes; however, it has difficulty in obtaining an accurate form and cracks may occur because of the significant decrease in sheet thickness in sections with a steep incline. To overcome the insufficient accuracy, a supporter method (**Fig. 1**) has been examined, by which forming of complicated and large panels such as quarter panels has become possible[4)].

For further improving the accuracy and suppressing the crack generation in the supporter method, we have devised a multi-head revolving tool with a special design at the tip of a cylindrical tool (**Fig. 2**). By using this tool, an improvement in shape fixabilities and a reduction in crack generation have been confirmed (**Table 1**, **Fig. 4**).

As another forming method without using a supporter, we propose a counter tool method using a counter tool together with the multi-head revolving tool (**Fig. 3**). In this method the parts are formed by drawing, thus resulting in remarkable suppression of the thickness decrease (**Fig. 5**).

An outline of these methods is described below. In both methods, the contour line tool locus system using the NC milling machine is adopted for the forming.

(1) Supporter method: A multi-head revolving tool and a supporter in the shape of the parts are placed on either side of the blank, and the parts are formed by revolving the tool, with a clearance of thickness +α retained.

(2) Counter tool method: A round sheet metal blank is supported with its center fixed, and the multi-head revolving tool and a counter tool placed on either side of the blank are used in combination to form the parts.

References

1) Matsubara, S. : J. Jpn. Soc. Tech. Plast., 35-406 (1994), 1258 (in Japanese)
2) Tanaka, S., et al. : Proc. Jpn. Spring Conf. Tech. Plast. (1992), 545 (in Japanese)
3) Hasebe, T., et al. : Proc. 46th Jpn. Jt. Conf. Tech. Plast., (1995), 39 (in Japanese)
4) Matsuda, F., et al. : Proc. 49th Jpn. Jt. Conf. Tech. Plast., (1998), 141 (in Japanese)

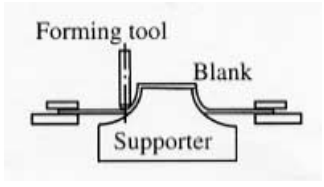


Fig. 1 Schematic diagram of supporter method.

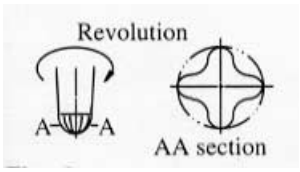


Fig. 2 Multi-head tool.

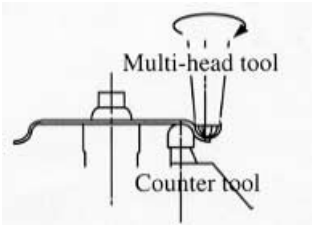
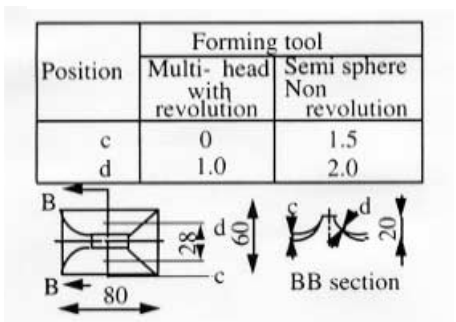


Fig. 3 Schematic diagram of counter tool method.

Table 1 Deviation of shape formed by supporter method (mm).

Position	Forming tool	
	Multi- head with revolution	Semi sphere Non revolution
c	0	1.5
d	1.0	2.0



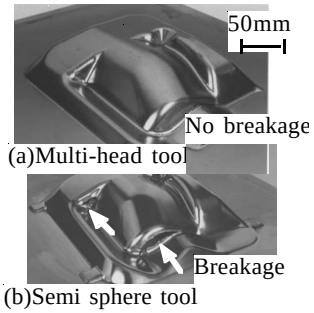


Fig. 4 Comparison of breakage in supporter method.

Average thickness of side wall(mm)	0.91
Blank thickness (mm)	0.99

Fig. 5 A sample formed by counter tool method and its thickness.