A NEW APPROACH OF VARIABLE MODULE GEAR CUTTING USING A TAPER ENDMILL WITH FEED SYNCHRONOUS MECHANISM

Hisanobu Terai[1], Teruyuki Asao[2] and Ryoichi Yagami[3]

[1] Department of Controll and Information Systems Egineering

Kitakyushu National College of Technology

Kitakyushu, Fukuoka Japan

[2] Department of Mechanical Egineering

Kitakyushu National College of Technology

Kitakyushu, Fukuoka Japan

[3] Supporting Section for Research and Education

Kitakyushu National College of Technology

Kitakyushu, Fukuoka Japan

INTRODUCTION

In this study a new method of gear cutting is proposed. This method is characterised by working out a variable module gear cutting using a one tool. The commonly used gear cutting is hobbing or gear shaping, and these gear cutting provide the mass production not for small-lot production. If we want only one gear, the gear is produced by the milling with formed tool which shape of cutting edge is the involute curve[1]. So the cost of the formed tool is not cheap, and it is not eazy to get. When some special gears or several types of gears are needed for a trial product in some company or labolatory, it is very difficult to prepare quickly in reasonable cost. For these situation this new gear cutting is inspired.

PRINCIPLE OF VARIABLE MODULE GEAR CUTTING

The most basic and classic gear cutting is a rack shaper. The rack cutter move reciprocatory and feed to tangential direction of gear. In the proposed method the cutter change to the taper endmill. And the work gear rotation and the straight movement of the tool feed is synchronized by the feed synchronous apparatus. This feed synchronous apparatus is attached on the table of the milling machine and shown in FIGURE 1. X direction is the feed direction of the milling tool and is connected mechanical to the gear rotation axis by the flexible belt. The movement of Y and Z direction is separated from the gear rotation axis.

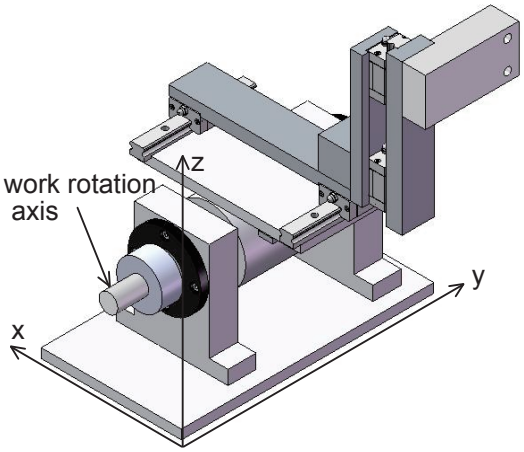

FIGURE 1. The figure of the feed synchronous apparatus.

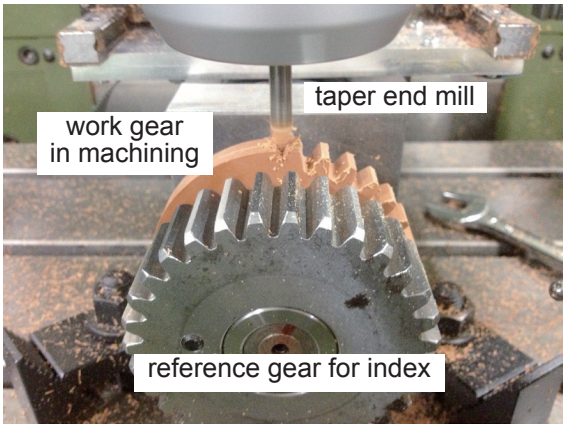

FIGURE 2. The situation of the machining test of this new gear cutting.

FIGURE 3. The left one is produced by the hobbing machine for the reference and the right one is the machined gear by new method.

MACHINING TEST

The situation of the machining test of this new gear cutting is shown in FIGURE 2. The tool is a taper end mill, its taper angle is 20 degree same as the pressure angle. The work material is the engineering plastic. The specification of the gear is as follows, the module is 2.5, the pressure angle is 20 degree and the number of teeth is 31. And the rotation speed is 1000rpm and the feed speed is 0.2mm/rev.. FIGURE 3 shows two gears, the left one is produced by the hobbing machine for the reference and the right one is the machined gear by new method. The error of the base tangent length is within 0.3mm. For index of tooth the reference gear made by hobbing is used, and this procedure is not automatic. So automatic indexing is the next issue to be solved.

In this machining test the depth of cut set for the module 2. Other module gear is able to be cut only changing the depth of cut in theoretical.

CONCLUSIONS

The new method of gear cutting is presented. And it is confirmed the feasibility with the machining test. This means that this new method expand the possibility of the multikind and small quantity production of the gear.

REFERENCES

[1] Shigeyuki Shimauchi, Osamu Okuda, A Method of Gear Cutting with a Simply Shaped Tool, Transactions of the Japan Society of Mechanical Engineers(in Japanese), 1988; 88-0659B: 1049-1052.