Dynamic Characteristics Analysis and Testing of Polymer Granite Structures

蔡連錦、羅正忠

E-mail: 9405656@mail.dyu.edu.tw

ABSTRACT

This paper explores polymer granite application on the structures manufacturing of machine tools. This kind of material has very good damping characteristics, which may effectively improve machine ’ s performances such as low vibration, high machining accuracy and efficiency. In this research paper, we have three different testing workpieces of rectangular-bars, square-tables, and horizontal welding structures. At first, rectangular-bars of steel and polymer granite material, which are not only analyzed by finite element COSMOS software but also tested by a equipment that contains a frequency analyzer, accelerators, and a hammer. Secondly, analysis and testing are executed on three square-tables, which are made from different material of cast iron, polymer granite, and quartz. The analysis software and testing equipments are the same as rectangular-bars. For horizontal welding structures of carbon steel, dynamic characteristics of polymer granites filled and unfilled welding structures are tested and compared. ANSYS finite element analysis is also used to compare with modal testing results of the above equipment. Polymer granites filled welding structure has higher resonance frequency and much lower resonance amplitude than polymer granites unfilled welding structure. It shows that polymer granite greatly improves dynamic characteristics of the structure. From the software analysis and testing results of three different testing workpiece, we can get a conclusion: The damping ratio of polymer granite is much higher than that of the other three different material (steel, cast iron and quartz). Therefore, we can say that polymer granite is a kind of good material, which can greatly reduce the vibration of machine tools.

Keywords : polymer granite ; dynamic characteristics ; finite element analysis ; modal testing ; damping ratio

Table of Contents

REFERENCES

[1] JOHN WILEY & SONS , VIBRATION DAMPING , 1985。

[2] Kim, Hyun Surk; Lee, Dai Gil, Mirror surface grinding of ceramics using a three-axis precision CNC grinding machine, International Journal of Machine Tools & Manufacture ; v 37 ; n 10 ; p 1499-1510 ; Oct 1997 ; 17 Refs。

[3] Ohama, Yoshihiko , Recent progress in concrete-polymer composites, Advanced Cement Based Materials ; v 5 ; n 2 ; p 31-40 ; Mar 1997 ; 94 Refs。

[4] Kim, Hyun Surk ; Park, Kyu Yeol ; Lee, Dai Gil , Study on the epoxy resin concrete for the ultra-precision machine tool bed, Journal of Materials Processing Technology ; v 48 ; n 1-4 ; p 649-655 ; Jan 15 1995 ; 11 Refs。

[5] 張金隆，"工具機新材料-人造花崗岩"，精密機械研究發展中心技術資料。

[6] 吳政憲，詹子奇，王焜潔，"高速化工具機結構靜動態特性測試與分析"機械月刊，88年三月，466-475。

[7] 吳政憲，陳明飛，詹子奇，謝銘雄，張雅惠，”PCB成型機結構分析及改善研究”，大葉學報，第八卷，第一期民國八十八年。

[8] Weck "Handbook of Machine Tools"Vol。2 74~85，1984。

[9] 孫葆銓，"工具機結構的新材料"機械月刊，83年4月號，200~205頁。

[10]孫葆銓，"瑞士MICRO-GRANIT聚合樹脂混凝材料"機械月刊，83年4月號，282~290頁。

[11]孫葆銓，"聚合樹脂混凝材料其他製造公司與國外研究總結"機械月刊，83年6月號，221~228頁。

[12]Studer公司型錄。