Deflection of Complex Geometry Cutting Tools

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Deflection of cutting tools under the action of cutting forces has a significant influence on the error of machined surface and the stability of cutting process. Considering the complex geometric structure of cutting tools lead to higher calculation accuracy of the tool deflection analysis. Therefore, CAD models of double-sided solid ball end mill and helical drill bit was created in this study. The impact of tool material and clamping of the tool under the influence of cutting forces individually in three axes was obtained via finite element analysis. An error of the numerical model was less than 7.2% and has been validated by analytical calculation. Geometric errors in the case of die and mold manufacturing are provided below or close to 0.02 mm. However, due to the force effect of the cutting process it is not recommended to use HSS tools as the analysis confirmed. Stiffness of sintered carbide tools was more than doubled.

Keywords: Deflection, Clamping, CAD, FEM, Solid Ball End Mill.

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