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An Outline of 2.5 Dimensional Prismatic Parts Machining

Viswa Mohan Pedagopu[1] and Dr. Manish Kumar[2]

[1]Department of Mechanical Engineering, Shoolini University, Solan, HP, India.
[2]Department of Production and Industrial Engg, J N V U-Jodhpur, Rajasthan, India.

Abstract

The 2.5D machining is composed of a series of 2dimensional paths on the XY plane at different Z levels. Various mechanical components are manufactured by milling, drilling and other machining processes of 2.5Dimensional prismatic components. Rough milling is responsible for removing most of the material, while the finishing stage can be performed in machines with up to 5 axes which is achieved by 2D part. A high material removal obviously, reduces production time, and helps the manufacturing processes become more rapidly and flexible. In this paper the advantages of generation of tool path for 2.5 D milling operation is considered by comparing with 2D and 3D.

Keywords: Prismatic components, 2D, 2.5 D, 3D and milling operation.

1. Introduction

In the mid of 1970 Woo first proposed a methodology for extracting geometric information from a model for 2½ D work pieces. The generation of tool paths for 2.5D milling operation is of great importance in the manufacture of prismatic components. A large amount of mechanical components have surfaces parallel or normal to a single plan that requires contributing to reducing the machining time. In order to generating paths for multiple tools used to remove a larger material as much as possible within a short time. Similarly, single milling tools are used to remove the remaining smaller material. The given pockets were machined by using the paths generation method by using various cutters. The paths generated by using various commercial software to reduce machining time, tool flank wear, and surface roughness.

2.5D components are very much ideal for machining, due to very flexible and easy to generate G-code. The grounding for algorithms in an efficient, most favorable fashion is possible with 2.5D parts then 3D parts. In machining, 2.5D refers to a surface which is a projection of a plane into 3rd dimension–generally referred as contour map. The thickness or depth of the part at each point can be machined on a 3-axis milling machine, and do not require any of the features of a higher-axis machine to produce. A 2.5D machine [two-and-a-half-axis mill], possesses the capability to translate in all three axes. The two-and-a-half-axis mill can perform the cutting operation only in two of the three axes at a time. However, the two dimensional axis X and Z positions for each hole center, where the spindle (Y-axis) axial for drilling operation. The operation completes a fixed cycle for drilling by plunging and retracting axially in Y direction. The code for a 2.5D machining is significantly less than 3D contour machining. The software and hardware requirements of 2.5 D are also less expensive than 3D. In 2.5D the drilling and tapping centers are inexpensive, limited-duty machining centers further, the software and hardware costs have dropped with advancing technology. A 2.5D image is a simplified three-dimensional (x, y, z) surface representation that contains at most one depth (y) value for every point in the (x, z) plane. 2.5D machining is when all the machining is in the same plane and that plane coincides with one of the planes of the milling machine. The 2.5D solid modeling functions useful to create 2.5D solid models, or to work from imported models, to model tooling like vise jaws, chucks, and fixtures, to correct and modify imported solids, and also to provide Computer Aided Manufacturing modeling functions. The efficient algorithms that perform automated setup sequencing and fixture planning can be executed by 2.5D parts are presented. A framework for the integration efficient setup sequencing algorithms with algorithms for fixture planning is developed. At a higher level of abstraction, these algorithms can be applied for automated process planning of 2.5D parts. The application of algorithms to situations where prismatic components are used in parts manufacturing. There is possibility of improved version of an existing algorithm for prismatic part using special software. A feature-based CAD/CAM environment an easy generation of prismatic part algorithms is possible with the efficient 2.5 than 3D. The decomposition of machining features generated into sub-features, selection of appropriate tools to machine these sub features, and the selection of appropriate cutting parameters.

The CNC milling of 2.5D prismatic enables to machine holes, pockets, grooves, bosses and threads quickly and easily Imports industry standard file types such as Drawing Exchange Files [DXF] Initial Graphical Exchange Specifications [IGES], and Standard Exchange of Product–Numerical Control [STEP-NC] for easy communication and to create easy and quick reliable tool paths in step-by-step process and saves much time. Combines single part programs into multiple part programs, minimizing programming times and supports headstone machining on both horizontal and vertical machines. Proven post-processors used for all major machine tools, in order to reduce machine commissioning time and general shop parts with simpleslots, holes and side features tooling fixture and fittings Covers, plates and brackets.

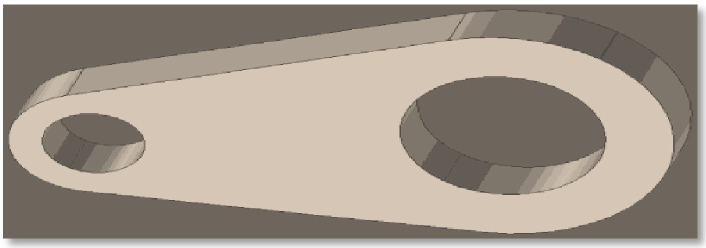

Fig. 1: A model 2.5 D prismatic component.

During the milling of 2.5D prismatic parts comprising features like slots, steps, pockets, etc. The advantages of the proposed model over previous works are that it (1) Extraction of feature from the given Computer Aided Design

(2) The translation of geometric specification into machine language and (3) Programming with G codes and M codes for Computer Numerical Control

In a typical feature-based CAD/CAM environment, process planning involves a number of steps such as feature recognition, selection and sequencing of setups, fixture planning and decomposition of features into machining operations. Selection of the sequence of setups and fixture configurations in which to machine the part account for a large portion of the time spent in manufacturing it. Though many commercial CAD/CAM systems do exist, there is always some amount of manual process planning involved, mainly when the cutting tools, machining parameters, setups and fixture configurations are to be selected. So, automatic generation of an optimal sequence of setups and fixture configurations would result in significant reduction in manufacturing time and help insure minimal human interference during machining.

2. Fixture Design for 2.5D Parts

The design or fixture for machining of 2.5D prismatic component is much easier than 3D part. The development of algorithms are much easier than 3D from feature Based model approach. 1. A number of algorithms have been proposed for near-optimal setup sequencing without consideration of fixturing constraints. 2. Algorithms have also been formulated for generation of near-optimal fixture configurations without concern for efficient sequencing of setups. 3. Algorithms have also been developed for optimal sequencing of machining operations within each setup. 4. One of the key issues is that development of algorithms both for minimizing the number of setups for machining the part as well as determining fixture configurations for each setup. Two classes of existing algorithms from previous literature- one for setup sequencing and the other for fixture planning- are integrated to obtain algorithms that achieve both these objectives. By considering various reviews previous work done in the area of automated (feature-based) process planning. 1. Discusses the concepts of features and feature based-models and presents an overview of the architecture of the feature-based process planning system. 2. Algorithms for automatic generation of setup sequences and part configurations, independent of the components used.3. Algorithms for fixture planning for each setup using standard fixturing elements. **[1]**

3. Process Planning for 2.5 D Machining

The process planning to manufacture a 2.5Process planning is much easier to compare with 3D part. The 3D part process planning is complex and critical because of [x, y, z] axes. The technique of generating a process plan for manufacturing a part from a given design using the three-axis milling process. The process planning can be subdivided into three steps 1. Macro plans, 2.Micro planning, and 3.Tool path planning. The generation of machining features from a prismatic Computer Aided Design model and the sequencing the order in which these features are manufactured called macro planning. Then Micro planning is concerned with the breakdown of features generated by the macro planner into sub features depending on feature geometry and on the tools available, the selection of appropriate tools, and the selection of appropriate cutting parameters. The tool path planning are the actual NC codes for the three-axis milling machine. Features generated by the macro planner can either be pockets or holes of a given diameter can be machined with drills of the same diameter. The large amount of material is to be removed from the stock at reduce time. Therefore, in order to machine a given pocket, it is necessary that large tools be used to remove large amounts of material quickly. It is necessary to subdivide a given pocket into sub pockets to be removed by different tools. **[2]**

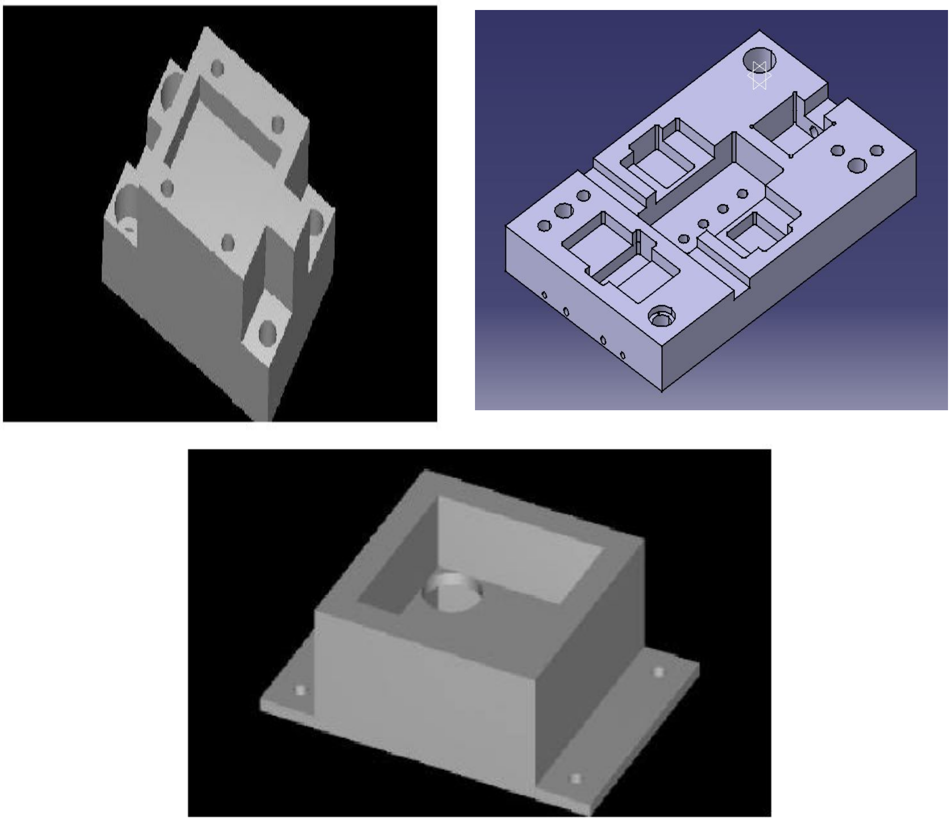

Fig. 2: Model 2.5 Dimensional components [1]

4. Issues in 2.5D Pocket Milling

Various issues addressed in selecting a sequence of end milling cutters to machine a 2.5-D prismatic part pocket feature. The minimum combined cost of tool wear and machining time, cutting parameters of the tools, the size of the tools, and the pocket geometry taking into consideration. The set of tools is trim by considering existing size called usable tools of the pocket by eliminating all other irrelevant tools without gouging. Within the usable set of tools, larger tools have smaller accessible areas within the 2-D contour of the pocket as compared to smaller tools. Moreover, the 2.5 D concerned with the depth of the part in y axis. The accessible area of a tool is always a subset of the accessible area of a tool that has a smaller diameter. These facts are valid under the assumption that the tool and tool holder assembly that not collide with the final component within the accessible area of the tool. **[2]**

5. Conclusion

This paper addresses 2.5-D components benefits in milling operation and easiness of machining of prismatic part. The comparison between 2D and 3D with respect to 2.5D components. The fixture design is easier than 3D components. Usable tools and unusable parts are selected based on pocket of part being machined. The feature of 2.5D is divided into subdivided into sub pockets if the feature is pocket as well as that have to be machined by different tools. The possibility of reduction of cost and minimize the time by using 2.5D parts. The brief description of fixture design for 2.5D parts and the macro, micro and tool path generation of 2.5D discussed.

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