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DESIGN AND MANUFACTURE OF 3D MODEL BY USING ARTCAM

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Abstract: In India most of the art models on wood are made by hand. The making of the art models manually results in inaccuracy of work (in most cases) as it depends on worker's ability and it would be difficult to work on mass production. The use of CNC for this purpose is limited only to some areas that to with no advancements in custom design and machining process. The use of the latest technology and designing advancements would bring an effective and efficient change in the art working industry. In this regard, an attempt is made to develop a customized high relief 3D art model from a 2D image using CAD/CAM application (Autodesk ArtCAM Premium 2008). Various modelling tools like vector tools, relief tools, texting tools, editing tools, layers, etc are learned and practiced. G/M codes are subsequently developed using suitable tools and optimum machining parameters defined from literature. To verify the intricate features a low relief model is developed first and machining test is performed over Medium Density Fibre (MDF) board using finish cut machining.

Key word: ArtCAM, CNC router, MDF.

I. Introduction of wood curving

Wood carving is a form of woodworking by means of a cutting tool manually or computer aided, resulting in a wooden figure or figurine, or in the sculptural ornamentation of a wooden object. The phrase may also refer to the finished product, from individual sculptures to hand-worked mouldings composing part of a tracery. One of the oldest types of art, woodcarving is a fine art normal to all societies, from the Stone Age onwards, not least on account of its far reaching accessibility, versatility and ease. Its solitary genuine disadvantage as a model for mold is its perishability. Being water retentive and

helpless against creepy crawlies and airborne growths, wood can debase quickly.

TYPES OF WOOD CARVINGS

Chip carving: Chip cutting or chip-cutting, is a style of cutting wherein blades or etches are utilized to expel little chips of the material from a level surface in a single piece.

Relief carving: Relief cutting is a kind of wood cutting in which figures are cut in a level board of wood. The figures venture just marginally from the foundation as opposed to standing unreservedly. Contingent upon the level of projection, reliefs may likewise be delegated high or

medium alleviation may also be classified as high or medium relief.

Scandinavian flat-plane carving: The Scandinavian level plane style of woodcarving is a style of figure cutting. The figures are cut in huge level planes, made principally utilizing a cutting blade.

Whittling: Shaving cutting may be a craft of cutting shapes out of crude wood utilizing a blade or a period involving, non-imaginative procedure of over and over shaving fragments from a bit of wood.

Chainsaw carving Chainsaw cutting is a technique wherein models made of wood are cut utilizing cutting apparatus. This sort of carvings are utilized for making figures which are immense in size where manual cutting utilizing apparatuses is exceptionally unimaginable and time taking.

Economics of furniture industries:

Indian furniture industry is assessed to be more than Rs. 60,000 Cr. The business is ruled by chaotic part, which establishes 90% of the all out Indian market. The composed furniture advertise is at 10% and developing at about 35% CAGR. Furniture section involves 65% of the home market and 35% of establishments. The whole home stylistic theme classification spends, furniture accounts about 68% of offer while staying 32% contains goods and home improvement. The economy thoroughly impacts the business, as furniture is a discretionary thing says Leslie Carothers of The Kaleidoscope Partnership, an electronic life and publicizing association focusing on the furniture business. "Right when the economy is incredible people are undeniably even more prepared to place assets into

furniture similarly as better quality furniture as they more money for such endeavors". What's more she acknowledges that, "whether or not a local economy is strong, furniture associations, regardless of whether retailers or makers, who are executing in the going with ways, are prospering in the present economy.

II. PROBLEM DESCRIPTION

1. Machining conditions like Speed, feed rate, depth of cut are considered.
2. Machining allowance like cutter radius compensation, tool offset are essential for parameter optimization.
3. Tool size selection was taken into consideration.
4. Machining economy in terms of above parameters also has considered.

I. EXPERIMENTAL SETUP

For this experiment the whole work is carried out on CNC router machine is a cutting machine which is controlled by inputs from a computer. The CNC router gets input in the form of G/M-codes from the computer [4].



CNC milling machine

The specifications of CNC router:

Type = Automatic

Length of bed	= 8 feet
Breadth of the bed	= 4 feet
Maximum spindle speed	= 18000 rpm
Power	= 4.5 KW

The work piece is fastened to the bed using clamps with T-bolts. These clamping is done to ensure that the work piece does not change its orientation during machining and is held rigidly. The tool used for machining is set and is fastened using collect chuck. The maximum diameter of the tool that can be accommodated was 12.5mm [9]

A. Cutting Tool Material



Ball nose milling cutter

Cutter Type	Ball nose milling Cutter
Tool Material	High Speed Steel
Tool Diameter	6 mm

CAD modeling:

Computer aided design (CAD) is the utilization of computers to help in the creation, adjustment, examination, or advancement of a design. CAD programming is utilized to expand the efficiency of the originator, improve the nature of configuration, improve interchanges through documentation, and to

make a database for manufacturing. CAD yield is regularly as electronic records for print, machining, or other manufacturing operations.

The work piece is manufacturing a model with the help of Art CAM pro 2008. Create model using into the Art CAM software. Vectors are created by using respective vector creation tools and vector editing tools. The vectors created help in creation of relief as vectors act as boundaries for the surfaces created using relief creation tools and relief editing tools.

B. EXPERIMENTAL WORKS

The 3D art modeling for eagle was carried out using Autodesk Art CAM which was the most prominently used software in the locality. Currently, in the vicinity of Uttar Andhra there are no modelers available and hence the model was imported from clipart library available in Art CAM. The model chosen was 'A Horse'. The dimensions of the model were defined, and the model imported into the workspace. A dimension of the imported eagle relief was 260x190x12mm.

TOOLPATH GENERATION AND SIMULATION OF THE MODEL

Currently, in the locality, the 3D art models are manufactured using CNC machines. For the purpose of manufacturing using CNC, tool path for machining the model are generated. The process of tool path generation involves the selection of area to be machined, type of machining operation to be performed, defining the geometry of tool

and machining parameters and setting up the dimensions of the work piece.

The tools that are currently used in the market are Ball Nose Milling Cutters made of High-Speed Steel (HSS). The tool geometry generally preferred by the machinists was ball nose milling cutters with a diameter of 6mm and flute length of 20mm. The cutting parameters that are currently in use for machining on MDF are as shown below:

- Spindle speed = 15000 rpm
- Feed rate = 76 mm/sec
- Stepover = 0.6mm
- Step down = 6 mm
- Plunge rate = 50 mm/sec

The finishing operation was the only method chosen for machining on MDF since the model was a low relief model, it was the only method used by the machinists in the locality and machines available did not have a configuration for tool change. The tool path for the whole relief was calculated only for finishing operation with the specified tool geometry.

The tool path generated and its effect on the model was virtually visualized with the help of simulation option available within the software. The simulated view of the tool path generated. The simulated view was useful in finding out errors in the tool path generated.

Tool path simulation using ArtCAM

The tool path for the 3D art model designed is generated using machine relief option available for machining 3D contours.

The generated tool path is then simulated in the workspace for real time visualization the path of tool travel and the final component prior to machining operation using CNC

MACHINING THE TEST MODEL

The machining of the test model on MDF was performed using a 3-axis CNC router. The G-codes for the machining operation are obtained from the toolpath generated. This G-code is exported and fed into the interface of CNC machine for carrying out the machining operation. The workpiece was then fastened to the machine bed by means of clamps with T-bolts. The origin of the router is fixed, and the model is machined.

CONCLUSIONS

In the state of Andhra Pradesh, many CNC machining services are available to carve 3D models on wood, but these manufacturers cannot manufacture custom models due to lack of modeling knowledge. So, in the present paper work an attempt is made to design as well as manufacture a custom model successfully. It was found that the surface roughness decreases with increase in spindle speed and increases as feed rate increases where as depth of cut will have lesser influence on the surface roughness. Also found that the machining time increases with decrease in feed rate and decreases with increase in feed rate where as spindle speed will not have an influence with machining time.

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