FEASIBILITY TO INTEGRATE THE PART CAD MODEL INTO THE CNC CONTROLLER TO ACHIEVE AUTONOMOUS DIRECT MODEL-TO-PART MANUFACTURING

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INTRODUCTION

Now days every product designers, manufacturers and inventers designed their products by using the modern technologies of computer aided drafting & design. AutoCAD is the most popular and common platform for CAD drafting & design services among all other platforms. Due to the emerging growth of CAD, the architects are becoming more sophisticated by lessening their dependency upon excessive paper drawings. This is resulting enough time saving to concentrate on their core activities and business. CAD is not only important in the field of architecture or mechanical engineering sector, but also very crucial in the area of graphic design, fashion design, toy design, packaging, computer gaming and movies. In most of the above highly sophisticated and fashionable sectors, CAD has been proven its vitality as an integrated part of digitisation with high clarity as well as output. CAD is a true asset for architects who are interested to have a robust career in any domain. The CAD system capable of making your work more easier and faster by removing the repetitive works, which not only faster the speed of the work, but also mitigate the stress upon the designer to lot extent due to repetitive works. Further more CAD system is the effective way for reducing the errors in design & drawings with high accuracy and quick turn around time. Now days many CAD design & drafting companies are providing complete project management to servetheentireresidentialandcommercialdesignneedofthearchitectsandengineers.

Material and method

In this paper, I will present the economical, technical, artistic, and research requirements of Estampa. Then I will present an analysis addressing the abstraction of the motifs and patterns to computational

metaphors. Finally, I will present several prototypes that were created and the final version in the user trials.

Requirements

The design and implementation of Estampa was shaped by a series of compromises of many requirements. The first task in the design of Estampa was to constrain the design space, focusing on the followingquestions:

- Should I constrain the research to address very specialized and narrow requirements or should I try to encompass a broad set ofneeds?
- What are the type and the number of requirements it shouldfulfill?

I decided to prioritize breath over depth, thus trying to meet a large set of requirements: economical, technical, artistic and research. I realized that all the areas of the research would be compromised by their lack of depth, but I couldn't focus in only one requirement since the specialized research that would result wouldn't be useful in a non-developed setting. However, in industrialized countries narrow specialized research can rely on the industry or governmental institutions to bear the responsibility to transform and deploy their research into reality. But research in developing countries is radically different than research in developed countries. In developing nations, the design/implementation industry is almost non-existent; thus, issues such as the deployment and economic cost concerning the technology must be part of the research requirements. Constraining my research for specialized goals would have rendered it unusable for the very people it was addressing and only useful for industrialized countries: a betrayal of my principle.

Economical Requirements

One essential requirement for introducing crafting software in non-industrial communities is that it should to be free and open source. Free CAD software is a necessity for the artisan in developing nations because he cannot afford prices for CAD software that are set in the economies of developed countries The price and sophistication of today's commercial CAD software makes it unaffordable and unusable tool in non-developed environments. The average Mexican artisan has a relatively small income in pesos and they will never be able to have the capital to buy the CAD software that is created for industrial purposes; it would not justify the expense. Moreover, the cultural mindset to buy books or software is not present in Mexico.Thebooksforpublicschoolareprovidedatnocostbythegovernment,andtheschoolsdonot

have a budget for buying software, they just have a budget for buying computers. Thus a first requirement for the environment that I develop should be:

- Free
- Have a relatively lowcost

Even if this requirement severely constrains the technologies that can be used, I think its better to have some rudimentary technology, and have the software available to a large community of artisans, rather than using the latest proprietary unaffordable technology.

4.1.2 TechnicalRequirements

Creating a CAD tool for artisans from the ground up would have been impossible due to time restraints, and it would have been a waste of time to recreate software already available. Thus, early it was decided to use a vector drawing program as platform that would be free and open source. The software neededto:

- Be a vector-based drawingprogram
- Open-source
- Have printing and savingutilities
- Have documentation, user guides and developerguides
- Bemulti-platform

Artistic Requirements

The motivation behind the program was to create a digital environment supported and constrained by the Best Maugard Technique. This was possible because Best Maugard describes in his book a technique that can be easily formalized into a series of motifs and transforms that can be programmed in a computer. Thus, the first step in the creation of the tool was to create the motifs. The second problem was how to parameterize these motifs. Finally, the means to combine these motifs should be provided. Thus, the artisan should be able to:

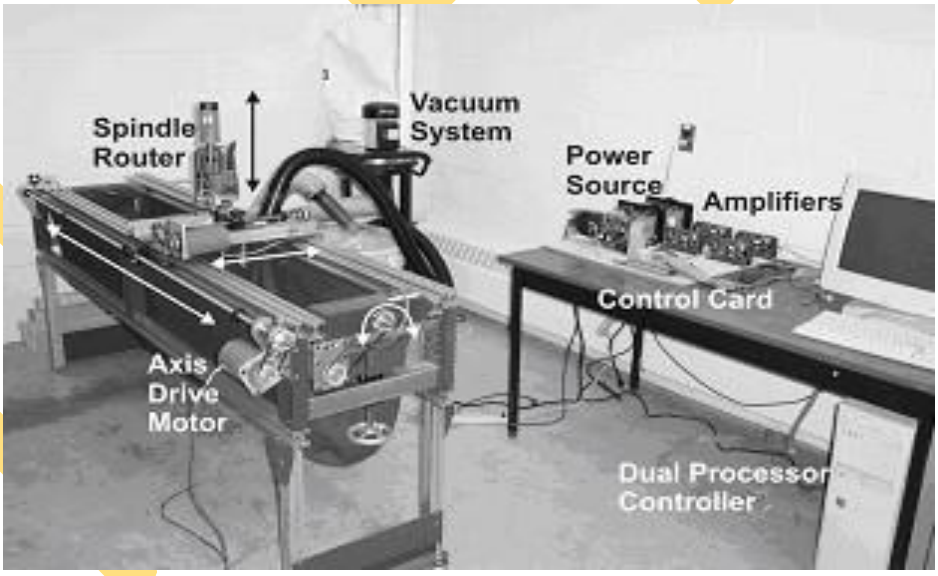
- Create themotifs.
- Parameterize themotifs.
- Create patterns with themotifs.

The most demanding issue is combining the previously cited elements to invent for a creative space:

CONCLUSIONS

The presented work demonstrates that it is feasible to integrate the part CAD model into the CNC controller to achieve autonomous direct model-to-part manufacturing. Thus, a single unified CAM, simulation and control system reside inside the machine controller.

The direct model-to-part architecture was implemented on a Single Axis Lathe using a PC to control the machine. The controller uses the computer's graphics hardware to assist in computing tool positions in real-time and to maintain a Live Model simulation of the motion of the tool and workpiece during cutting. Machining experiments showed the system to be reasonably accurate, though the machine was not constructed to high tolerances. The helical tool path limitation of the Single Axis Lathe will be eliminated by the construction of a 4-Axis Router machine. The 4-Axis Router will be the basis upon which the direct model-topart architecture will be expanded to machine industrialparts.



4-Axis Router machine

The new system will require intelligence and decision-making capabilities to find an appropriate way to machine the part and eventually to optimize the whole manufacturing process.

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