Methodology for Production of Earthen Pot Profile Making - A Review

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Abstract—This paper presents the process forming of earthen pot by automatically with the related search. The study specifies factors influencing the clay forming process and recommends a number of design options for an automated forming system. These are based on a systematic analysis of the forming process and testing of a prototype forming system consisting of a standard articulated robot. For which we consider literatures reviews &some of them are explained.

Keywords: Automation, robotics, manufacturing systems, clay forming, process analysis, terracotta.

I. INTRODUCTION

The art of pottery is one of the oldest skills known to the Indians. From time immemorial, lumps of clay were mounded by hand to form toys and deities of worship. The advent of the potter's wheel gave man the opportunity to make beautifully shaped pots for his personal use. Over time, this craft evolved into various specialized categories like simple clay pottery, glazed pottery, terracotta pottery, blue pottery, paper thin pottery, etc. which are being practiced in various parts of India today. Control Theory to drive Inv-IM. Pottery is probably the commonest find on most archaeological sites. In most circumstances organic material will decay and metals corrode. Potsherds tend to be more stable. For this reason archaeologists frequently use fragments of pottery as aid to help them date their sites. The craft of glazed pottery has its origin in Persia. The craft reached perfection in the country in time Excavations carried out in Persia have revealed that the early potters were familiar with the use of luster of different hues, one of the few things apparently which the Chinese potter did not employ, even if he knew that metallic luster was a serviceable medium for decorative purposes. The art of glazed blue pottery came to India through Persia. Earlier, Egypt and Mesopotamia were in possession of blue tiles this art, introduced by the Muslims in India, underwent transitional changes. While it declined during the conservative Mughal king Aurangzeb's time, it later flourished in Jaipur during Maharaja Sawai Ram Singh's time (1835- 1880). He sent the local artists to Delhi to be trained by the famous potter Bhola. The descendants of the very first potters still practice the craft. Sawai Ram Singh set up a school of art and encouraged artists and craftsmen from all over the country to come and settle in Jaipur and practices the craft. This ancient craft is one of the oldest in Rajasthan. Today, many schools of pottery are scattered in different parts of the state. The blue pottery of Jaipur is the most exquisite and best known all over the world. The potteries as conventionally made by manually. Manual pottery makes has inherent defects like precision, quality, finish, consistency, low production etc. The skill of labor is the greatest concern of the industry. The mechanization of the profile making operation is solution to such issues.

II. CONCEPT

Introducing automation was to overcome problems with the current manual forming method. In mechanism there are a numbers of uncertain factors such as, the thrower must lean into the bottom of large pots and apply the force required for forming. Consider also some aspect of the pot output: lubrication, forming tools, pot stability, and turntable speed, forming speed, outside pot support, consistency of blank size, and forming force. The concept of the work is,

1. Observe the manual process to identify the important process variables,
2. Quantify the important process variables.
3. Develop a prototype automation system which could control some or the entire process variable.
4. Investigate all areas of automated forming.
5. Produce a specification for an automated system.
6. Refined design of the forming tool, as this plays a major role in all forming operations. The above considering point we design the automated skilled manual process, which would avoid the worker fatigue.

III. LITERATURE REVIEW

Literature review areas of research considered in the past, to be explained the approaches used & the new ideas. It is an assignment of previous task done by some authors and collection of information or data from research papers published in journals to progress our task. It is a way through which we can find new ideas, concept. There is lot of literatures published before on the same task; some reference papers are taken into consideration from which idea of the project is taken, the other reference will we discussed later.

A. Hämmerle, Dr.-Ing. VDI (Germany) [1]: This paper presents results of a feasibility study undertaken by the University of Auckland for a tile and pottery company in New Zealand. The study specifies factors influencing the clay forming process & recommends number of design options for an automated forming system. These are based on a systematic analysis of the forming process & testing of a prototype forming system consisting of standard articulated robot. The project results indicate that carefully selected & designed automation technology may be affordable and beneficial for small and medium sized enterprises.

The experiments carried out showed that the Scorbot light industrial robot was suitable as a prototype system for automated pot forming. The prototype system performed the wall forming operations successfully. It produced pots with tapered walls with a maximum angle increase of 7 degrees between each run, and pots with circular walls with a minimum radius of 146 mm curvature. Experiments involving smoothing the wall-base transition and putting a spiral in the pot base produced visually

acceptable but not consistent results. These two areas need further investigation. The prototype system had a slower forming speed than the manual process, caused mainly by its limited load capacity and the simple shape of the tool. It is, however, anticipated that these limitations can be easily resolved. The main aim of the project was to find out whether it is possible to automate a skilled manual process which would avoid worker fatigue and would enable the production of terracotta pots larger than 1 m in height. The experiments carried out showed that it is possible to automate the pot forming process. Two suitable automation systems were identified and a recommendation has been made to use a gantry type robot.

Fig. 1: Light industrial robot forming a medium sized terracotta pot.

Systematic analysis of the manual forming process and the use of a prototype automation system provided objective requirements that could be used for the embodiment design of the final automation system. Results of the analysis provided a clear insight into the forming process which helped to clarify which aspects of the overall process need to be controlled, not only for designing the automated system but also for quality assurance purposes. It is anticipated that eventually the automated process will also lead to a reduction in training costs, less scrap and therefore less material and labour costs, and reduce staff recruiting problems. The co-operation between industry and university worked well in bringing different experiences and resources together

B. Martien Kampel & Robert Sablatnig[2]:

This paper gives an overview about an automated archivation process & 3d-acquisition with respect to archaeological requirements. Also presents the developing a documentation system for archaeological fragments based on their profile, which is the cross section of the fragment in direction of the rotational axis of symmetry. The main technical goal of this project is to perform automated classification &reconstruction of archaeological fragment by using the profile section of the oriented object & additional attributes belonging to the fragment. The finally to provide a tool that helps archaeologists in their activation process.

C. ROBERT SABLATNIG & CHRISTIAN MENARD:

This paper represents the 3D reconstruction of archaeological pottery using profile primitives. The language holds all features of the fragment as primitives & all properties among features as relations. Classification of newly found fragments of unknown type is performed by comparing the description of already classified fragments by computing the graph similarity. The sub graph with the highest similarity is then used to reconstruct the complete vessel out of the fragments.

D. DAVID HUSON & DENBY POTTERY:

The primary aim of the project 'Solid free-form fabrication in fired ceramic as a design aid for concept modelling in the ceramic industry' was to prove the commercial viability of 3D printed ceramic bodies as a design tool for concept modelling of tableware and white ware for the ceramic industry. A further aim was to investigate ceramic firing supports and their advantages in the production of one-off ceramic design concept model, achievement of this project as follows;

- Collaborated with designers from Denby Pottery, by using both existing production shapes and concept model designs to develop a method of producing 3D printed and fired ceramic concept models.
- Explored the design considerations and physical and material constraints for shape and form to suit the 3D printed bodies.
- Collaborated with Denby Pottery design and technical team to develop custom supports and profile settings in order to fire complex ceramic items.
- Investigated the potential of producing short run bespoke ceramic designer items and one off ceramic artworks by working with an internationally renowned ceramic designer (Peter Ting) and a group of ceramic design students from the Royal College of Art.
- Undertook a survey of the UK and European ceramic industry to establish the state of the art of the use of 3D printing and rapid prototyping techniques in tableware manufacture

Fig. 2: Before and after firing

As can be observed from the images above it was possible to 3D print in the ceramic material and to achieve a well-defined model with a good surface and with adequate

green strength. However during firing the material is not strong enough to support itself and collapses! This behavior was not entirely unexpected because the way that a 3D printed ceramic material behaves during the firing process is different from a conventionally formed ceramic material. This is due to the alterations and compromises that need to be made to a ceramic body to enable it to be formed by the 3D printing process. In conventional clay based ceramic bodies mechanical pressure forces the constituent particles together in water based suspension or paste. During the firing the clay gradually changes from a plastic material that binds together the body matrix to a component that reacts with the fluxes and other ingredients to form a glass like material that holds the matrix together.

IV. Research Methodology

According to related literature review, we will collect required data development of specific mechanism for required profile and will evaluate these results with animated model perform on present task and analyze these results. Also considering the some points mention below,

- Observe the manual process to identify the important processvariables.
- Quantify the important process variables.
- Develop a prototype automation system which could control some or all of the process variables.
- Investigate all areas of automated forming.
- 5. Produce a specification for an automated system.
- Refined design of the forming tool, as this plays a major role in all forming operations.
- Accurate control of turntable speed, possibly with the capacity to interface to the controller.

V. Specification Of System Requirement

For planning robot applications, a sequence of planning activities and decisions is recommended to guide the system designer from the initial concept through to the detailed robot configuration. One activity common to all systematic engineering design is the specification of detailed system requirements. The results obtained from the prototype experiments were used for analysing the detailed requirements. The starting point was identifying exactly which axis of the Scorbot had been used to perform forming operations. Analyses of this data showed that movements in the X, Y, Z and tool pitch directions were used. However, further testing showed that movement in the Y-axis could be avoided with the use of a variation in tooling angle. That is, if the roll of the tool was adjusted it performed the same role as having the robot axis of motion offset from the centre of the pot. This angle would need to be adjustable for two positions. With further analysis it is possible the two positions could be reduced to one, by use of more advanced tooling. Therefore, it was concluded that the automated system must be able to move through two axes, one vertical and one horizontal. There must be accurate positional control over these axes and the ability to move through programmable contours with control of speed and force. In addition, the automated system requires two degrees of control over the tool, one being the pitch of the tool face, and the other being the roll of the tool. As neither of these requires continuous position control, it is likely that simple set position actuators could be used, thus simplifying the control requirements. An articulated robot such as the one used in the prototype system, but with a higher load capacity and greater working envelope, would be ideal for forming pots for the following reasons: high flexibility, easily programmable, excellent reproducibility, high positional accuracy, and turnkey system. Such a system, however, with a 2.4 m working envelope and a maximum payload of 10 kg would cost around $90,000 according to quotes from industrial robot suppliers and would therefore be too expensive for a small company. An alternative to this system would be a gantry type robot. Gantry robots are positioned above the work area, and are commonly used for moving heavy masses and fit into small work spaces. They can be configured for a high degree of positional accuracy and offer the ability to move at high speeds. Components with the capability to be used for continuous path motion in 2D space, with the desired positional accuracy and robustness are readily available in the market place. The general arrangement would consist of two linear slide tables, one 1200 mm long in the vertical direction, the second 500 mm long to move in the horizontal direction. In addition, an actuator would be required to move the tool between vertical and horizontal axes. This would give access to the wall and the base of the pot. Costs were estimated to be approximately $30,000, with additional costs occurring for design and set-up.

VI. Conclusion

The main conclusion will be drawn find out whether it is possible to automate a skilled manual process which would avoid worker fatigue. Also the future scope for developing the generalized mechanism for any profile can be identified.

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