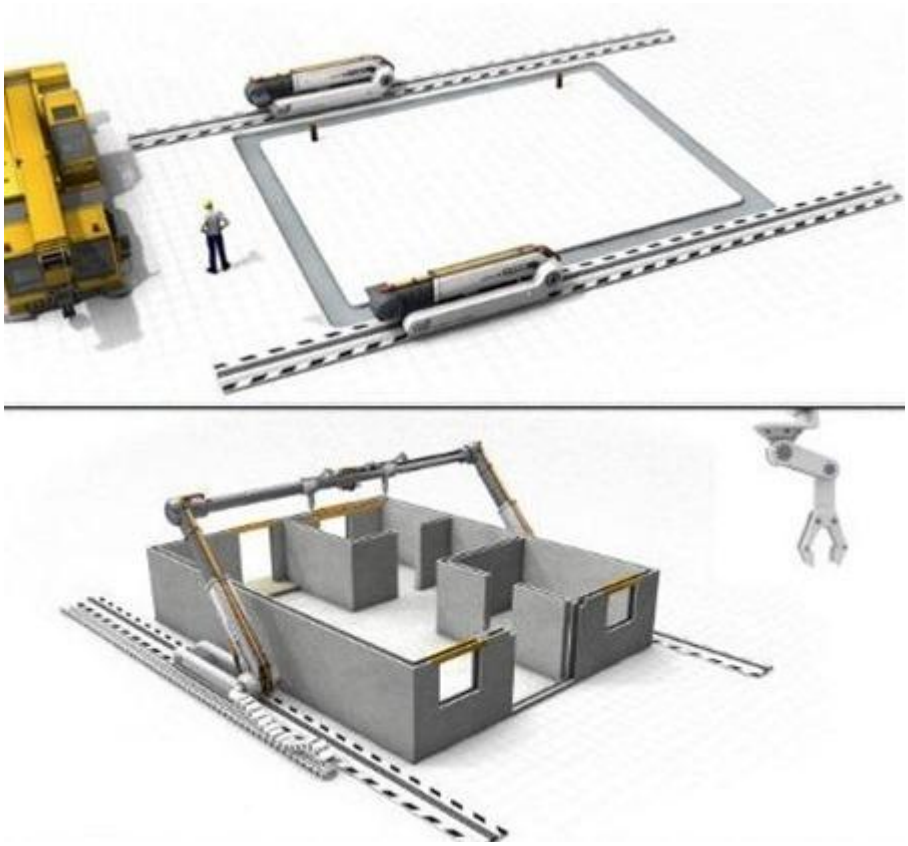
Contour Crafting | Houses Of The Future | Houses Built By Robot

Contour Crafting is a mega scale layered fabrication process which builds large scale three-dimensional parts such as individual houses, apartments, complex etc., by depositing paste materials (clay, cement, plastics etc.,) layer by layer at faster speed and with superior surface quality.



Contour crafting (CC) is a method of layered object manufacturing (LOM) process that uses polymer, ceramic slurry, cement, and a variety of other materials and mixes to build large scale objects with smooth surface finish.

Process:

The extrusion process forms the smooth surface of the object by constraining the extruded flow in the vertical and horizontal direction to trowel surfaces. The orientation of the side trowel is dynamically controlled by a robot to conform to the slope of surface features. The side trowel allows for thicker material deposition while maintaining smooth surface finish. Use of thick layers by other Layered Manufacturing processes is not possible because rough surfaces finish will be resulted, especially for slant and curved surfaces. Furthermore, in most processes thick deposition is physically not possible (e.g., adhesive liquid or laser cannot penetrate too deep into powder in a controlled manner). Thicker material deposition cuts down fabrication time, which is essential for building large scale objects. In Contour Crafting maximum layer height is limited by the side trowel height. As the extrusion unit moves according to the predetermined material deposition path for each layer, the smooth outer and top surfaces of each layer rim are first created, followed by the filling process which fills the internal volume with material either by pouring or injection.

Contour Crafting Machine:

The machine mainly consists of an extrusion unit and the trowel control mechanism. The extrusion unit carries uncured ceramic paste into material carrying tank and a linear ball screw driven piston pushes the paste through a Contour Crafting extrusion nozzle. With controlled rotational speed of feeding motor, stabilised extrusion flow can be achieved. When complex shape of geometry is being fabricated, the system controls the angle and orientation of the side trowel to conform to outside surface geometry each cross sectional layers.

Ingredients:

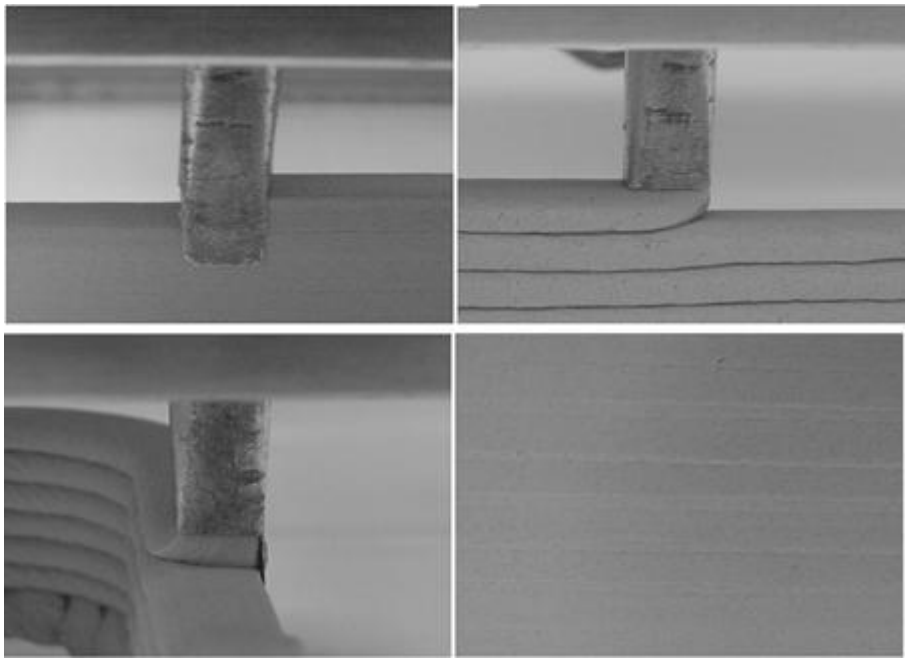
- Mineral Talc
- Highly plastic fine particle clay
- Witherite
- Soda Ash
- Water glass or liquid glass
- Water by mass

Preparing the Clay:

The clay parts were fabricated at room temperature and then bisque-fired in a kiln at 1063°C~1066°C for 10 hours. For glazing, a second firing at 1003°C was carried out for 8~9 hours. Large parts could be made with the assurance that the clay would not sag or collapse inward.

Loading defects and Precautions:

A way of loading clay into material carrying tank was devised in order to avoid entrapping air inside the tank. Entrapped air typically causes some defect modes at fabricated parts as forms of voids, excessive dry shrinkage, weak structural integrity, etc. A filling method was devised using a funnel shape apparatus that enabled continuous insertion of clay into the tank and pre-extrusion processing of the material also seemed to significantly reduced the void and defect surface formations.



Advantages:

1. Faster fabrication speed

2. Possibility of integration with other robotics methods for installing internal components such as pipes, electrical conductors, and reinforcement modules to enhance mechanical property

Future phases of the project:

- To include geometric design issues,
- To research in deployable robotics and material delivery methods,
- Automated plumbing and electrical network installation, and
- Automated inspection and quality control.

Source:

http://www.mechanicalengineeringblog.com/3380-contour-crafting-houses-of-the-future-houses-built-by-robot/