CNC SPONGE-FORMING AND PARAMETRIC SLIP CASTING: A HYBRIDIZATION OF COMPUTATION AND CRAFT FOR ARCHITECTURAL CERAMICS

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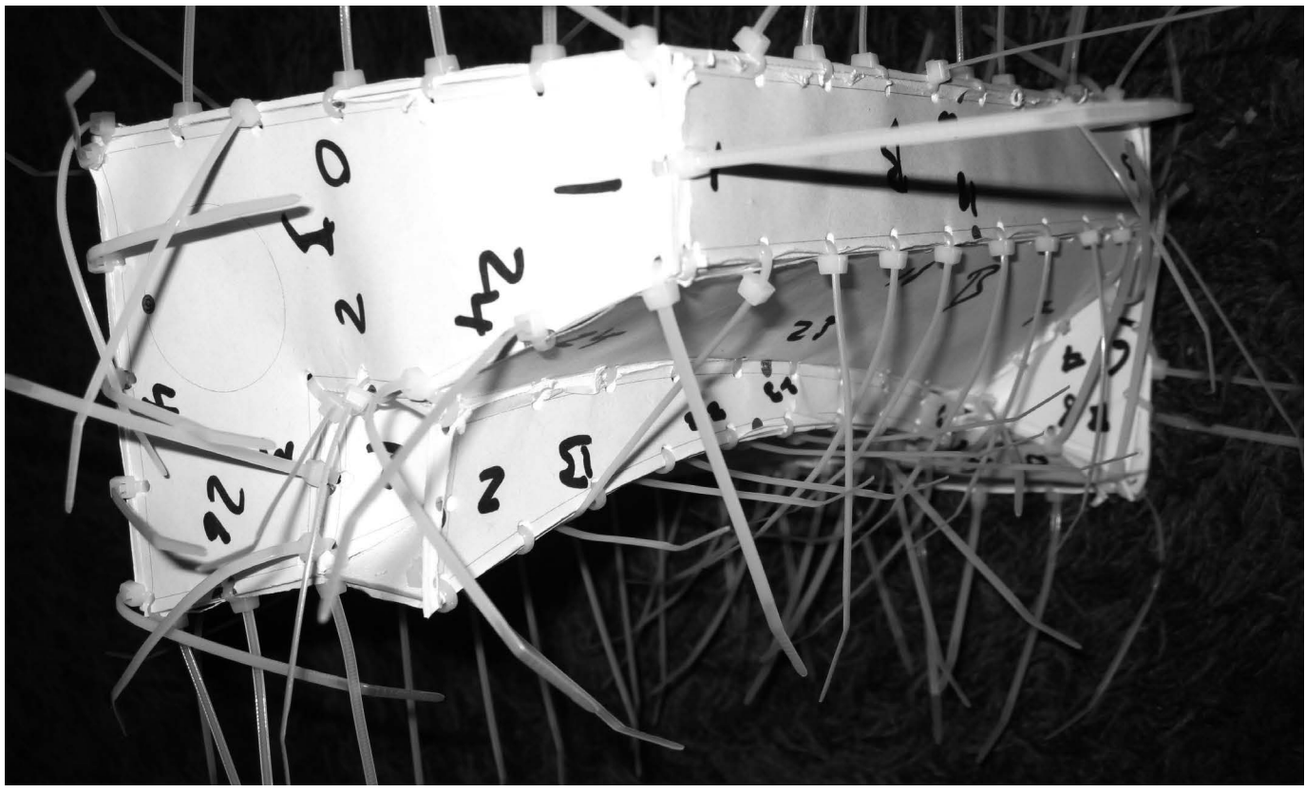


1 Stitch and Pour Pre-Formwork

Traditional casting techniques for casting complex forms in liquid clay require mastery in the forming and shaping of plaster. Plaster is a porous material which, as a molding matrix for clay, has the dual benefit of possessing an incredible ability to absorb water, combined with a relative inability to adhere to dried clay. Plaster, however, is both heavy and brittle. This means that as the dimensions of the piece to be cast grow larger, so too do the logistical complications of moving and de-molding large, heavy plaster molds (Reijnders & EKWC 2005). CAD CAM technology offers solutions to these issues (Celento 2009). The constraints of traditional slip casting can be freed to explore large or complex forms.

STITCH AND POUR FORM MAKING

Extrapolating from a stitch-and-glue boatbuilding process for wood, a form was devised for a lofted trumpet form to be cast in clay. A traditional process would result in a multi part mold to address undercuts. The benefit of modeling in the computer allows direct modeling of complex multi-part molds, but the surfaces of which can be manipulated directly to avoid undercutting. The result of this thinking is a "stitched" form work for casting a plaster mold for slip casting (Figure 1-2).

CARVE AND POUR FORM MAKING

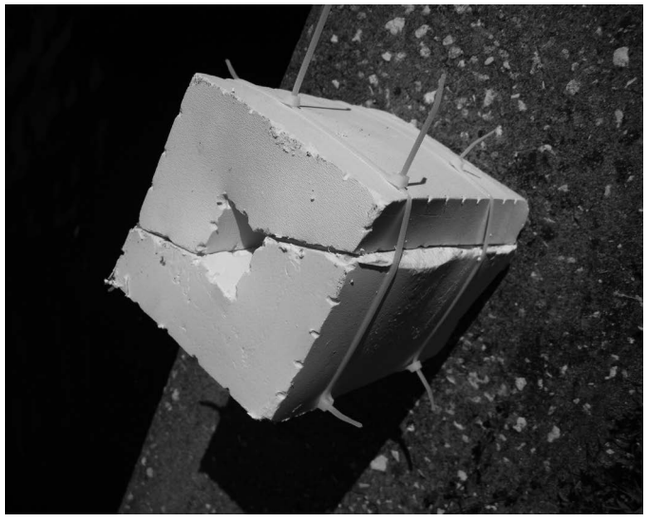
Traditional mold making requires a "sculpt and pour" process in which a hand sculpted prototype is used as a positive for a plaster mold making process. CNC positive patternmaking for plaster molds is an obvious first step in engaging this traditional process from the computer. In a tangential line of thinking however, the three-dimensional modeling process can be understood instead to have already created a virtual positive. While the value of a model versus a simulation should be understood to be different, an effective type of empirical process can be undertaken by skipping the positive form, and instead sculpting, from plaster, a negative form for the casting of positives.

CNC SPONGE FORMING

CNC milled, flexible, open-celled foam can be used as a "lost positive" for complex forms in ceramics, which would be either impossible or prohibitively expensive using traditional plaster mold making practices. Inexpensive open cell foams have a tendency to spall, melt or accumulate at the end of a rotary cutting tool, or to actively deform away from the tool with each pass. The research accounts for this behavior by stiffening the material using combinations of rice or potato starch, cellulose gum, or even dried clay.

SCALY EXTERIORS, PROTOTYPES FOR ARCHITECTURAL DEVICES

A traditional multipart mold for a highly textured part would contain many thousands of pieces. Pyramidal surface bumps, while shaped to aid demolding, create such surface area that friction between the part and the mold makes removal of the part impossible. Additionally, the flat, hollow shape tends to collapse in the mold from the weight of unsupported wet clay. Drawing from industry, a pressurized slip casting technique calls for a manifold of perforated tubing to be placed in the plaster for demolding via direct pressure. The mold interior is also pressurized against collapse during curing.



2 Completed Plaster Formwork

ACKNOWLEDGEMENTS

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WORKS CITED

Celento, D. J. (2009). Digital Craft Meets the Ancient Art of Ceramics: Would the Bauhaus Approve? Proceedings of the 13th Congress of the Iberoamerican Society of Digital Graphics, (pp. 104-106). Sao Paulo.

Reijnders, A., & EKWC. (2005). The Ceramic Process: A Manual and Source of Inspiration for Ceramic Art and Design. London: AC Black.

MARK WESTON is an Assistant Professor of Architecture at the University of South Florida where he founded the digital fabrication laboratory for the school of architecture. Weston's research is multi-disciplinary, combining experimental building materials, digital fabrication, and physical computing with traditional notions of making in order to generate interactive and complex physical environments. His work situates digital architecture between art, construction, and the environment rather than as a method for production optimization. He uses artwork as a medium to showcase his concepts at multiple scales. Exhibitions of his electronic sculpture, kinetica, and material investigations have been showcased around the world.