# Guerilla Tactics of Parametric Design

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## Abstract

Our assumptions about the world of technology and design are leading us astray. We are being pulled unequivocally towards notions of efficiency (time and cost) and towards the idea that we are buying ourselves back into the business of design development. In reality we are not repossessing anything, but are simply passing our cost and time savings on to our consultants, contractors and clients. Parametric design, BIM (Building Information Modeling) and digital fabrication methods are rendering us, as architects, further obsolete and creating a world in which we are even more likely to create another big box store or a second lot of condos, with only the requisite shift in material or articulation. We propose to demonstrate that an alternative method could be deployed using the complex capabilities of parametric software to further the form and compositional possibilities of vernacular materials.

The integration of parametric software into the design and construction process allows for multiple construction details/techniques and designs to be pursued quickly and simultaneously once a defined set of parameters are connected to a geometrical set. These parameters enable the software to reject a possible design whenever any criteria are not matched. The power of parametric design software is paramount when dealing with the interdependent systems and advanced compositional characteristics of alternative geometries now being utilized by architects and engineers.

Parametric software's capabilities mimic the controls of other three-dimensional software, except that it incorporates associative geometry through a set of constraints. These constraints allow for articulated structural geometries to be parametrically linked to a control geometry(ies). These parameters allow the entire model (structure and skin) to be controlled by definable objects or curves, including regulating geometry, a Boolean variable or a mathematical equation. This method provides for a high level of geometric control that can easily be modified even very late in the process. As well, this software allows customized details to become a variant of a base detail, essentially utilizing the software to allow a set of mass customized details to permeate the system.[1]

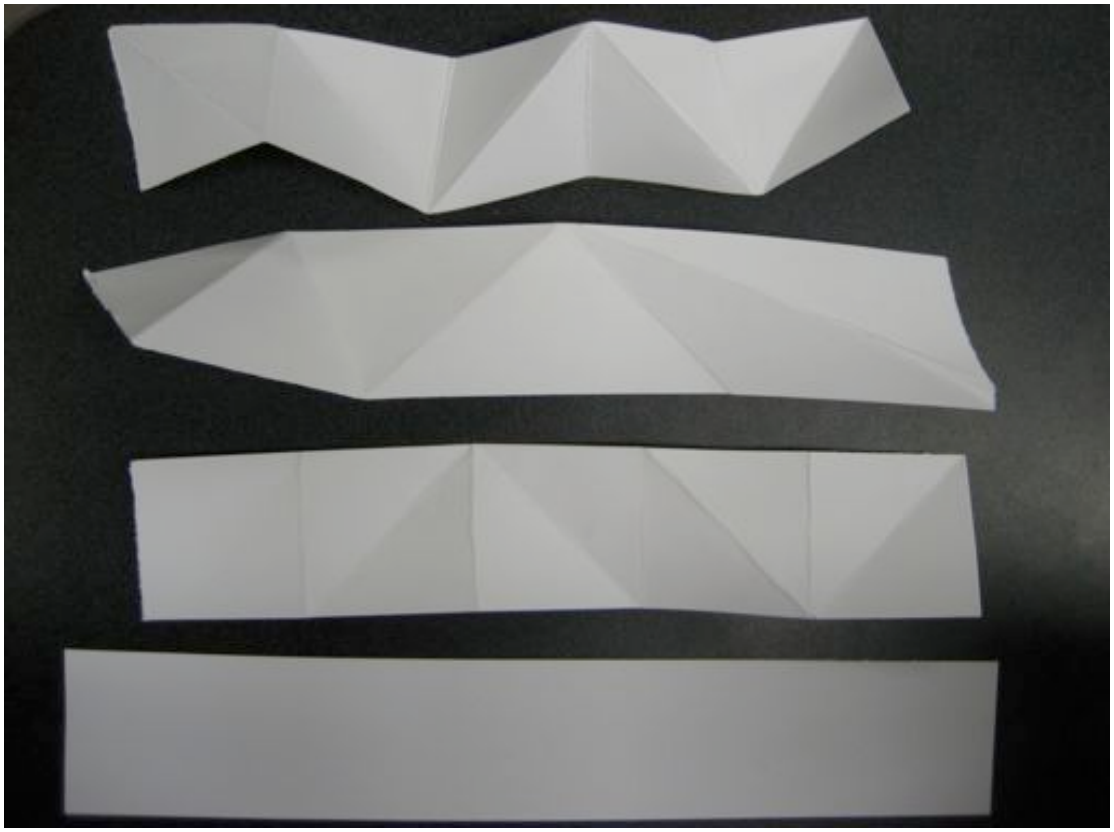

**Figure 1**- Tessellated paper models

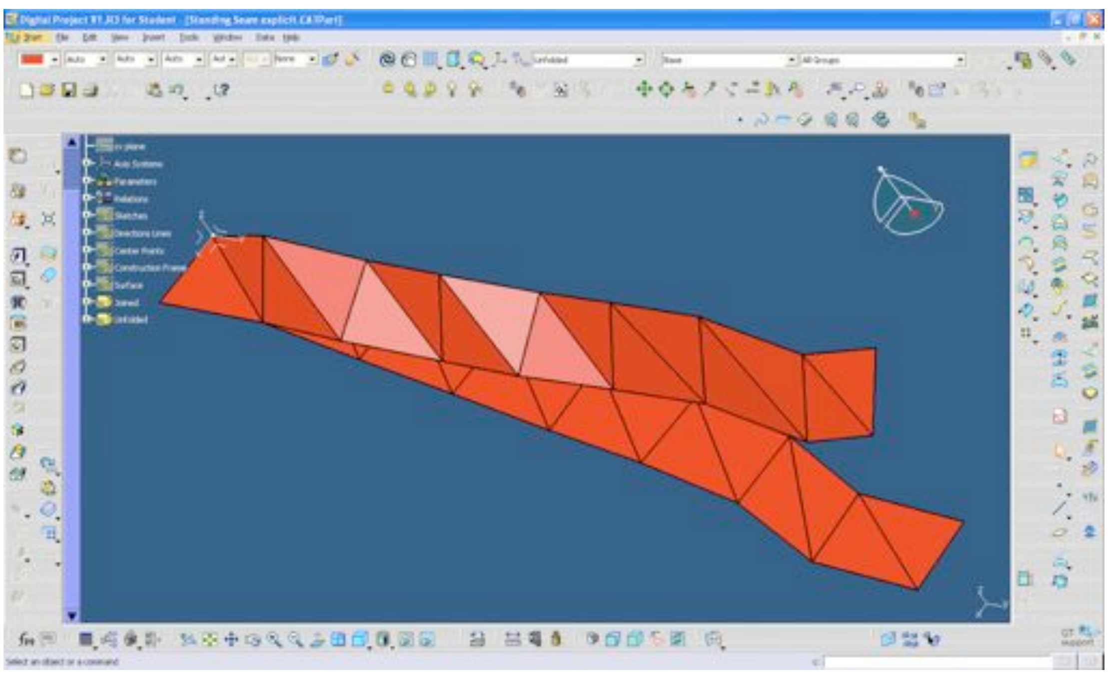

**Figure 2**- *Gehry Technologies Digital Project* (CATIA)

We propose to reconceive the way in which we use the capabilities of this software. We must begin, not conclude, by defining the formal limitations of the material or construction method we intend to use. We will use the software to delimit the material and construction constraints of a conventional method.

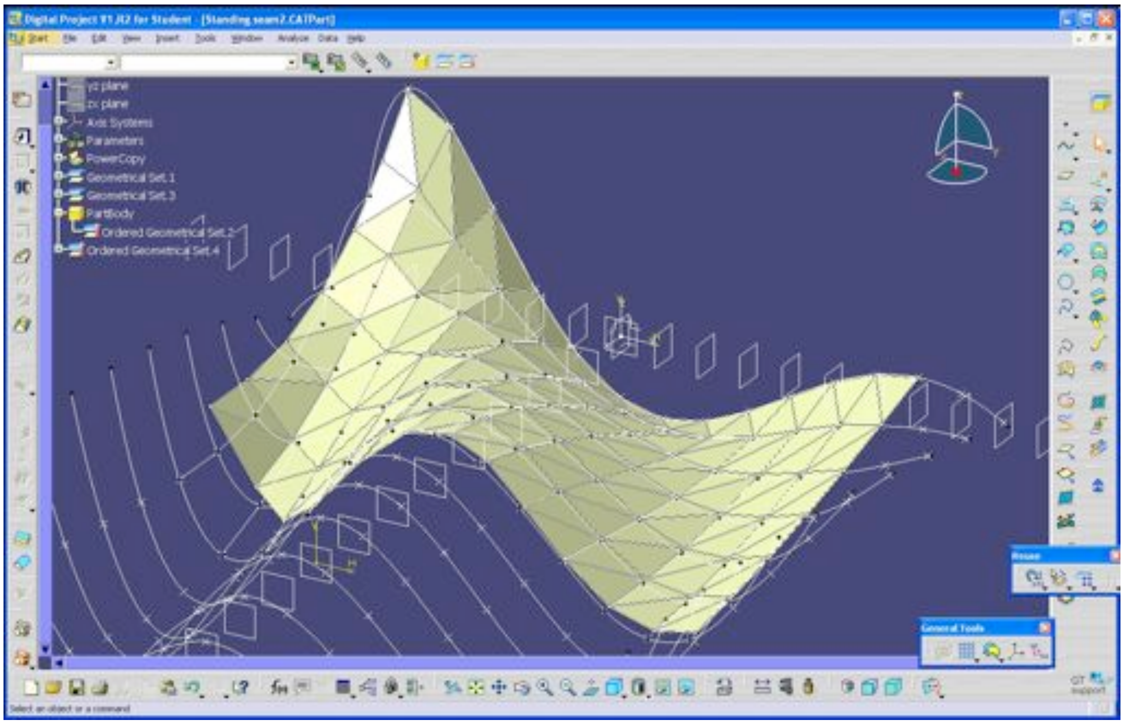


**Figure 3-** *Gehry Technologies Digital Project* (CATIA)

The use of CATIA, or other parametric design software, could just as simply use a bow/banana truss or a space frame as construction methods, if only the form were generated backwards to the definition of these components. We propose that in fact this is a far more ethical and constrained method for deploying the software. We begin by defining and analyzing a system that we would like to explore. One of the first methods we attempted to use was conventional metal roofing, manufactured throughout the world and deployed in a myriad of types, environments and programs. Firstly, we modeled a typical section of 5-V metal roofing, tessellated but maintaining the typical interlocked connection along its seams and through a bracket back to a structural grid.

**Figure 4-** 5V Metal Roofing test

This model functions within certain limitations that were derived from the software. In fact, the system is far more constrained than we might have imagined. Each time a component or triangular shape panel takes on a steeper or more shallow angle it can have a direct effect on the piece immediately connected to it, and dramatic effects on components further down the line. We have also realized that this model does not function with the typical lofted surface. The geometry is linked such that to have two curves defining a surface does not allow for the relational movement the system calls for.

The alternative to using a predefined surface is to use the constraint systems built into the software to constrain distinct points to one another. Each constraint whether coincident, or planar, allow for distinct types of movement at each point in the system. Then the user can use this predefined “flat” model to articulate patterns and see immediately the effects that moving one point will have upon the rest of the system. As well, one can begin to find moves, which the system simply cannot accomplish. The larger the system gets, the more panels it requires, the more constrained the system becomes and the closer to completely flat the system will be.

**Figure 5-** 5V Metal Roofing test

**Figure 6-** Standing seam test on frame

Though the method doesn't accommodate specific forms that a designer may envision, it gives the designer a form driven by its materiality. This method can make for a much more culturally coherent and connected design method, one which expresses efficiency and takes advantage of digital fabrication methods not as a method for making elitist icons, but for making inexpensive, yet poignant designs.

The tools embedded in the parametric technology such as CATIA create a system for the use of large sheet metal goods to be cut down inefficiently and applied to skeletons of disjointed and grotesque usages of steel and structure. In contrast, we can use the same software to create methods for deploying conventional materials in unconventional. Though parametric software has become synonymous with excess and flippant design, it is also, perhaps for the first time, capable of understanding a material’s constraints; we must choose how to employ these tools or risk that our profession will become further removed from the definition of our environment.

## Endnotes/ References:

Figure 2- Folded and unfolded standing seam model.

Figure 3- model of Standing seam metal roofing bent (broken) to form an unconventional skin.

[1] This method is called power- copying, where one detail complete with its relationships to a control surface(s) are instantiated throughout other joints with similar control surface(s) or curve(s). http://www.gehrytechnologies.com/products-designer.html

Figures 4 & 5- To test this hypothesis we modeled up the skin with 5V metal roofing a material very typical throughout rural America. This material made for an excellent test as we were able to quickly trace our unrolled surfaces onto them and break them into tessellated forms. Though key characteristic of this material is our ability to use the conventional overlapping connection between panels and to the structure.

Figure 6- We imagine that this same system could function far more cleanly with a typical run of standing seam metal roofing. With standing seam metal roofing we will have to connect using brackets and very specifically locate the points of connection prior to construction. The system we proposed will cut the seam along each edge at particular intervals defined by the system. This geometrically defined and constrained system limits the form, by connecting the moves which are made along one edge of a surface by pulling or pushing on the opposing edge, to increase the area of the shape near the altered edge.

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