GSD 6319 CAD CAM Final Project: Fabric Clamp and Structural System

John Middendorf
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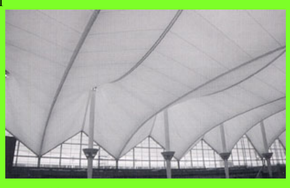
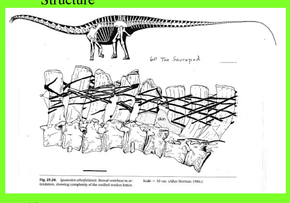
My interest in Tension Fabric structures led to me think about new ways to create a structural system for fabric roofs for my Cad/Cam final project.

An interest in the mechanics of the vertebrae structure of animals encouraged the development a segmented structural system, which offers an infinite possibility of curvatures.



Above: Tension Fabric Structure



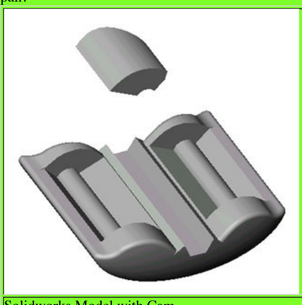
Above: Sauropod Vertebrae Study

After a visit to Birdair in Buffalo, New York, I discovered that the joining of fabric panels was a major cost of the fabrication of PTFE coated fiberglass fabric roof systems. I began to think of fabric clamping methods that would eliminate the need for heat welded seams.

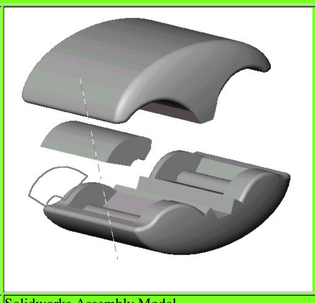
Using Solidworks, I modeled the structural fabric clamp, which then was saved as a .STL file which was used to print out a wax model on the Thermojet 3D printer. Chris Kane Casting Studio in Pawtucket, RI, then used my wax parts to create aluminum parts using a lost wax casting method. Originally, I wanted to have a one-piece main body to which a cam would be inserted in one end, but after discussing the limitations of the gravity casting process with Chris Kane, I opted for a two-part main body with two captured cams.

The Fabric Clamp uses a logarithmic spiral cam with a 12.5 degree cam angle(using the equation: radius=e to the sine theta times the sine of the camming angle). The cam grabs the fabric once it is inserted based on the coefficient of friction between the cam and the fabric. I found the friction coefficient was not adequate between the aluminum and the PTFE coated fiberglass, so I glued sandpaper on the cam which worked fine. I choose the logarithmic cam as the force of clamping of the fabric is proportional to the fabric tension, thus moderating the maximum tension on the fabric. In addition, it offers a system where the fabric is secured over a surface and is not subjected to point loads or severe bends.

Pairs of the fabric clamp will be connected with a ring to offer stability and to retain the desired angle between sections. Overall curvature is created by the variance of how the rings are fixed into each pair.

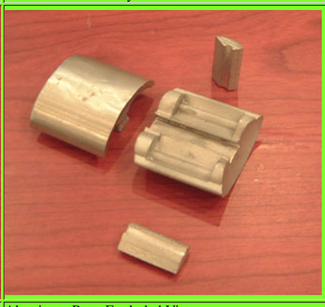


Solidworks Model with Cam

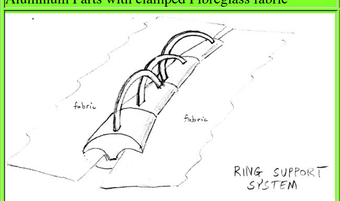


Solidworks Assembly Model

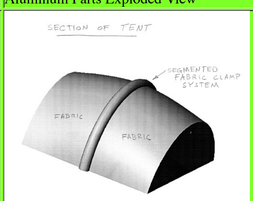
Aluminum Parts with clamped Fibreglass fabric



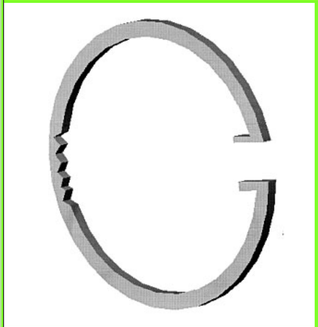
Aluminum Parts Exploded View



Sketch of proposed ring support system



Simple application in full scale tent



Connecting Ring for each pair

Presenting the work on 1/17/2001