



CASE STUDY /

## **Rethinking the Underwire by Attenuating Breast Tissue Stress Using Ansys Transient Simulations To Optimize the Support Structure and Placement — Veil Intimates**

“Our company uses Ansys finite element modeling to optimize structural support for technical garments. For example, our analysis resolves the placement and material properties of a support structure designed to replace the underwire for a brassiere. Dynamic movement and tissue variation make the FEA model an ideal way to accelerate decision-making and scientifically driven design specifications.”

**Benjamin Stewart**  
Engineer / Veil Intimates™

The garment industry is negatively affected by a lack of design innovation due to a lack of scientific basis for most functional garments like cycling shorts and brassieres. In the last 50 years, there has been no noticeable change in the design and fabrication of these two complex and dynamically protective garments.

### / Company Description

Veil Intimates is an apparel innovation startup company, guiding brands to new technologies in women's apparel. Our patent-pending process and patented design within a bra cup eliminates various comfort and design limitations. Our technology uniquely leverages additive manufacturing capabilities for mass production, which allows our customers to cost-effectively incorporate the bra component into their existing product lines.

### / Challenges

The problem we set out to solve was how to optimize the comfort of the support structure in a brassiere. Finite element analysis allows us to target this unaddressed need by:

- Quantifying the forces associated with the discomfort caused by an underwire.
- Iterating through design patterns to optimize support while minimizing tissue stress.
- Reviewing the strain energy in the insert during each manufacturing step.

### / Technology Used

- Ansys Mechanical

### / Engineering Solution

With Ansys Mechanical, we can:

- Quantify the stress concentration created by the underwire.
  - This empowers us to make scientifically sound relative statements about our products' supportiveness and "pain points" versus the underwire.
- Regionally define where support within a bra most substantially reduces stress and strain.
  - Full anatomical and geometric torso models quantify the attenuation of stress on the breast tissue for sizes, shapes and gaits.
- Simulate the manufacturing press that deforms the insert from 2D to 3D.
  - This resolves design problems early in the process.
- Simulate breast tissue dynamics and optimize a support factor for our design.
  - Stress, deformation and energy are used to quantify effectiveness.

### / Benefits

- Our company has produced dozens of prototypes efficiently using simulation based comfort testing and validation.
- Time saved is most noticeable in the products we have manufactured overseas, where turnaround times are longer.
- Our business depends on our differentiator: We use physics-based design to ensure the comfort and support of our garments.

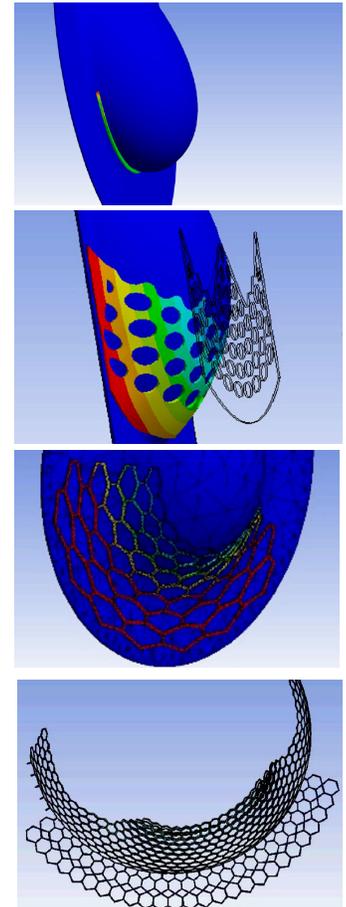


Figure 1. Breast and underwire stress map (top). Displaced in the mechanical press – side view (second from top). Dynamic tissue support – front view geometric breast and support – (second from bottom). Complex insert design testing (bottom).

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