

3D Virtual Draping with Fabric Mechanics and Body Scan Data

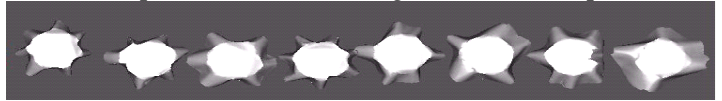
Traci May-Plumlee, leader; Jeffrey Eischen (NC State)

The modern apparel industry is characterized by companies with divisions, suppliers and customers spread over the face of the globe. Virtual systems that realistically represent apparel products in 3-D would allow individuals across the entire industry (apparel producers, suppliers and their customers, even people within the same company and the ultimate consumer) to communicate about products visually and almost instantaneously. Use of such systems would facilitate design, product development and marketing efforts in the business-to-business environment, leading to better products, more product successes, fewer incorrect products produced and faster design and product development. The technology would also support mass customization and e-commerce efforts geared toward the ultimate consumer. The fit of a garment is tremendously influenced by fabric properties. Until these can be integrated into a virtual representation, 3-D virtual draping will not fulfill its potential as a technology for improving business processes.

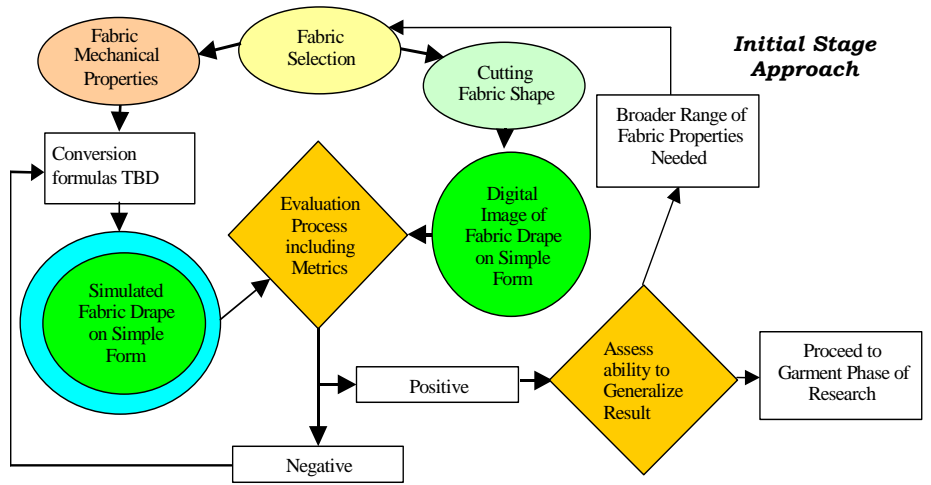
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We are developing methods for accurate virtual 3-D draping of apparel on a digitized 3-D model of the human body considering variations in fabric mechanical properties. Our strategy is to build on baseline 3-D draping capabilities to incorporate fabric mechanical properties so that variations in those properties will be represented in virtual apparel simulations. We will study the relationship between fabric properties and virtual drape using simple forms, then progress to virtual representation of apparel items on the human body. Along with this effort, we are developing methods for measuring the accuracy of simulated 3-D drapes.

Fabric Drape Varies Substantially with Fabric Properties

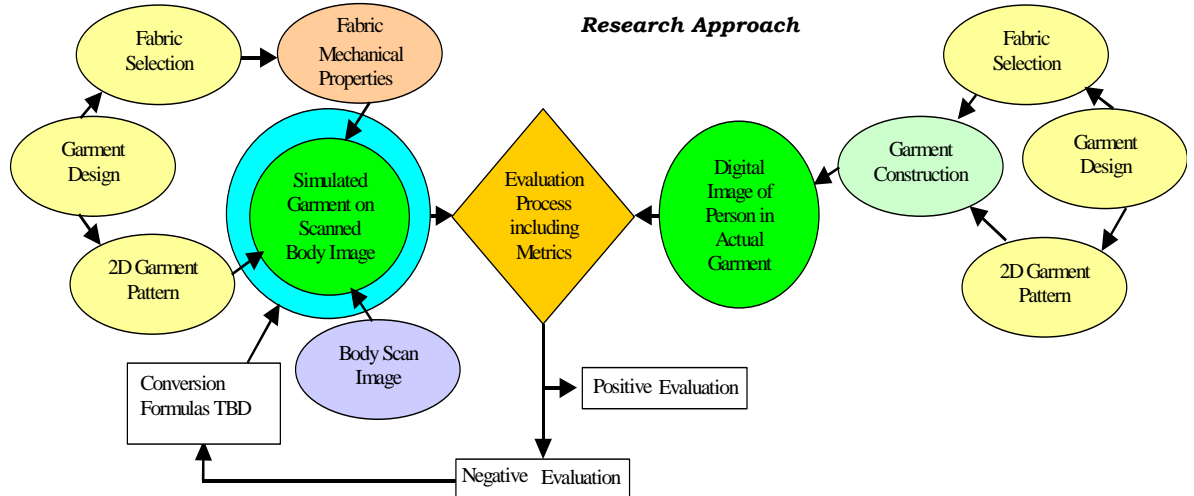


Simple circles of cotton fabric draped over a cylinder. Fabrics include single jersey and double knits and plain, twill and basket weaves.

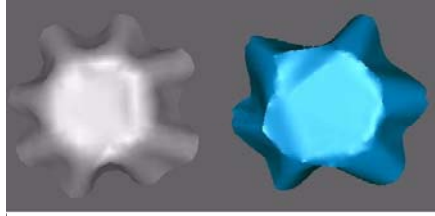


In the commercial realm, some CAD/CAM companies have implemented the ability to generate a visual representation of a finished product from 2-D shapes that represent garment parts. One of the limitations of these systems is that very little is known about how fabric properties can be represented by a virtual simulation. In fact, there is no evidence, other than anecdotal, that these visualizations even represent any real fabric, let alone one with specific properties. Fabric drape can vary substantially with fabric properties (See digital images above). The differences in drape are apparent.

Initially, we are focusing on integrating fabric mechanical properties into the virtual draping software (See Schematic above). In that regard, we have focused on working with simple forms, like those in the digital images above, and a limited number of fabrics. Ultimately, the process will be applied to garment designs and combined with body scan data to simulate trying on a garment, as shown in our overall approach (See Schematic below). Though beyond the scope of this project, once the foundation is laid for vir-



tual draping to incorporate fabric properties in the draping of apparel, it can be applied to simulation of home furnishings and industrial products as well.



Sample Drape Comparisons

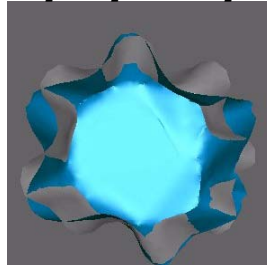


3-D digital images of a sample fabric (blue), and simulated drapes (grey).

We have begun generating both simulations and digital representations of sample fabrics to serve as test cases for determining our methods of evaluation (See Sample Drape Comparisons).

By superimposing a drape simulation and a 3-D digital image, 3-D metrics, such as depth of folds and number of folds, can be applied to evaluate the success of the simulation (See Superimposed Drapes).

Superimposed Drapes



A virtual drape (grey) and a digitized actual drape (blue) are nested in 3-D space for comparison.

Once we have sufficient success with draped samples to instill confidence in our conversion formulas, we will progress to working with apparel.

Contributors: Graduate Students: Narahari Kenkare, Pradeep Pandurangan (NC State); **Others:** David Bruner, Kim Munro, Mike King, Elizabeth White ([TC]²).

Industry Interactions: 7 [[TC]², ScanVec Garment Systems, D-Three, PAD Systems, BP Amaco Fibers, Sara Lee Corp., AATCC]

Other Non-NTC Academic Interactions: 2

Project Web Address:

<http://www2.ncsu.edu/unity/lockers/project/ntcprojects/projects/F02-S08>

For Further Information:

1. N. Kenkare and T. May-Plumlee, *Fashion In A Digital World - Meeting The Challenges of the New Millennium*, International Foundation of Fashion Technology Institutes, Int. Conference papers on CD-ROM, 828 (Nov. 2002).
2. T. May-Plumlee, J. Eischen, N. Kenkare and P. Pandurangan, *Evaluating 3D Drape Simulation: Methods and Metrics*, International Textile Design And Engineering Conference (INT-EDEC) 2003, (accepted, due Sep. 2003).

Traci May-Plumlee, an Assistant Professor in Textile and Apparel Technology and Management at NC State, joined the faculty in 2000 after 12 years at UNC-Greensboro and Southern Illinois Univ. Traci earned a Ph.D. in textile technology and management from NC State in 1999, a M.S. from Arizona State in 1988 and a B.S. in apparel design from Kansas State in 1981, and from 1982-88 she worked in industrial apparel design and development. Her research interests include textile product design and development, especially the impact of technology on the process, and managing innovation in demand driven business environments.

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traci_may-plumlee@ncsu.edu

919-513-4196

http://www.tx.ncsu.edu/faculty_center/directory/detail.cfm?id=76



Jeffrey W. Eischen, an Associate Professor of Mechanical and Aerospace Engineering at NC State since 1986, received a Ph.D. in Applied Mechanics from Stanford University. Jeff has been involved with the College of Textiles in interdisciplinary research for several years. His research interests include finite element numerical analysis of fabric drape and manipulation, dynamics and control of flexible mechanisms and stress analysis in layered microelectronic media.

I92-S3, F95-S20*, F98-S04*, F02-NS08

eischen@eos.ncsu.edu

(919)-515-5263

<http://www.mae.ncsu.edu/faculty/faculty.html>

