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## *Materials*

*Research in the design, development, manufacture and measurement of natural and synthetic polymers and fibers, including polymer mixtures and additives.*

## Bio-Active Fabrics

We are developing fabrics that contain genetically engineered cells that will enable them to generate and replenish chemical coatings and chemically active components. (Fowler) [M00-D03]

## Nanocomposite Fibers

We are developing biphasic fibers intimately blended with nanosized rigid particles, such as nylon/clay or carbon nanotubes, to produce vastly enhanced fiber properties. (Kim) [M00-D08]

## Optical Fibers, Fiber Amplifiers and Lasers

We are developing fluoropolymer fibers that are more flexible, thus easier to install, than glass fibers now used for optical fiber-based communication networks. (Ballato) [M01-C01]

## Surface Modification of Fibers with Nanolayers

We are developing ways to create "smart" multifunctional responsive/adaptive fibers by modifying their surface with hybrid polymer nanolayers. (Luzinov) [M01-C03]

## Dynamic Chameleon Fiber Systems

We are developing fibers whose optical characteristics (e.g. color, absorbency, reflection) can be controlled by an internal or external electrical field. (Gregory) [M01-C07]

## Ultrafine Fibers from Electrostatic Spinning

By refining our electrostatic spinning techniques, we seek a way to produce <0.1µ diameter fibers for such uses as filtration, light weight composites and "smart" fabrics. (Rutledge) [M01-D22]

## High Modulus, High Tenacity Melt Spun Fibers

By understanding the orientation distribution function of polymer chain segments, we hope to develop structure/property relationships leading to higher strength fibers. (Michielsen) [M01-G01]

## Fiber Structure Evolution During Spinning

We are investigating strain induced morphology development in fibers to understand the evolution of structure during the fiber formation process. (Jacob) [M01-G04]

## Lewis Acid-Base Complexation of Polyamides

By suppressing interchain amide group hydrogen bonding during spinning and drawing, we hope to develop ways to nylon fibers with higher strength and modulus. (Tonelli) [M01-S03]

# *Fabrication*

*Research in the design, development, manufacture and measurement of fibrous structures, including yarns, textiles, garments, nonwovens, carpets, coated fabrics, papers, preforms, etc.*

## Fiber Hydroentanglement Using Pulsed Elliptical Jets ***Report Not Submitted***

Pulsing an impinging jet flow through elliptical holes increases fiber splitting and bonding and improves filtration efficiency in nonwovens. (Ellison) [F98-C04]

## Ultra-thick Cross Section Composites

We are developing models to optimize fiber and resin parameters important to the manufacture of thick cross-section composites. (Kim) [F98-D04]

## Fiber-Particle-Airflow Interaction

We are developing the knowledge base that can lead to more efficient machines, shortened production lines and novel processes to convert fiber batt directly to yarns. (Wang) [F98-G15]

## Modeling of Ductile Braided Composites

***Report Not Submitted***

Our models of hybrid braided composites can predict processing conditions and initial failure well, but post-yield ductile response requires additional modeling. (Pastore) [F98-P01]

## Automated 3D Fabric Part Handling

We are developing efficient and optimal fabric part handling technologies for automated processes. (Eischen) [F98-S04]

## Fiber-on-Fiber Friction

We are investigating the friction behavior of fibers and energy dissipation under dynamic loading conditions. (Qiu) [F98-S09]

## Microelectromechanical Fabric Formation Systems

We are developing fundamentally new approaches for processing fibers into textile structures using microelectromechanical systems technology. (Hodge) [F98-S12]

## Filling Yarn Insertion in Air Jet Weaving

We are developing a model to better understand fiber and yarn motion dynamics in air-jet weaving. (Adanur) [F99-A10]

## Multi-component Cotton Blending Variability

To develop reliable measures of multi-component blending, we are analyzing the transient nature of variability and variability conservation laws. (El Mogahzy) [F99-A13]

## Fiber Motion in High-Speed Air Flows

We are developing models to elucidate the behavior of fibers in high speed air streams. (Oxenham) [F99-S06]

## Substrate-Coating Interaction in Coated Fabrics

We are developing a model to predict interactions between a deforming fiber and its coating to optimize structural configurations of coated fabrics under complex loading. (Chen) [F00-D06]

## Architectural Fabric Structures

We seek to understand and optimize the mechanical behavior of nonlinear anisotropic fabrics under tension to create new architectural fabric structures. (Messinger) [F00-P01]

## Engineering Non-Linear Elastic Blended Fabrics

We are modeling and designing blended fabrics for the nonlinear elasticity requirements for such uses as arterial grafts, performance cycling apparel and erosion control fabrics. (Dunn) [F00-P05]

## Magnetic Ring-Spinning for Increased Speeds

By replacing the traveler in ring spinning with a disc that rotates in a magnetic field, we hope to maintain the high quality of ring spun yarn, but at much higher speeds. (Abdel-Hady) [F01-A02]

## Nonlinear Dynamics of High Speed Transport in Non-Uniform Yarns

We are developing nonlinear models that predict the tension and balloon shape of non-uniform yarns (e.g. staple yarns) undergoing high speed translation and rotation. (Goswami) [F01-C04]

## One Step Carding-Spinning

We developed a new two-step process to convert raw staple fibers to yarns, and are now enhancing the fundamental understanding of the final carding-spinning step. (Wang) [F01-G06]

## Micromachines in Fabric Formation

We are developing new ways to process fibers into textile structures using micro electromechanical systems and small robotic devices. (Seyam) [F01-S14]

# *Chemical Processes*

*Research in dyeing, finishing and waste reduction in textile processes.*

## Antimicrobial Textiles

We are developing textiles which can release reactive chemical species, especially those with extensive antimicrobial activity. (Broughton) [C98-A17]

## Delivering Additives Embedded in Textile Fibers and Polymers

We are embedding textile additives into polymer and fibers during spinning. (Tonelli) [C98-S01]

## Simultaneous Dyeing and Finishing

We can impart water-repellency to fabrics by incorporating hydrophobic groups into the backbone of commonly used reactive and disperse dyes. (Freeman) [C98-S04]

## Closed Loop Desizing, Scouring and Bleaching

Using suitable enzyme systems we developed a closed-loop process that replaces conventional textile preparatory processes to desize, scour and bleach cotton. (Buschle-Diller) [C99-A07]

## Chemistry and Transport in Super and Sub-Critical Fluids

We are studying the solubility and transport of dyes and chemicals in super- and sub-critical fluids and their interface with textile substrates. (Drews) [C99-C03]

## Improving Textile Ink Jet Printing

We are developing fundamental knowledge of the flow, droplet formation, and droplet/substrate interaction in two-phase ink jet printing. (Carr) [C99-G08]

## Dye Diffusion in and Surface Treatment of Fibers

To minimize dye streaks, we are studying dye diffusion in and surface treatment of fibers using laser scanning confocal microscopy to measure the 3-D distribution of dye in fiber. (Tonelli) [C99-S04]

## Non-Aqueous Fabric Finishing

We are investigating using high energy plasma to create a continuous non-aqueous fabric treatment system, encompassing desizing, scouring, dyeing and especially finishing. (McCord) [C99-S09]

## Abrasion Resistance of Durable Press Cotton

We are developing a fundamental understanding for the loss of abrasion resistance in durable press cotton fabric. (Lickfield) [C00-C01]

## Quantum Dots as Dyes and Optical Brighteners for Fibers

We are varying the size of semiconductor nanocrystals to color fibers by diffraction over the entire visible range of the electromagnetic spectrum. (Srinivasarao) [C00-G03]

## Rapid Design of Novel Chemicals for Textiles

We are integrating combinatorial organic synthesis, high throughput screening and chemoinformatics to develop novel chemicals for the textile industry. (Bhat) [C00-P01]

## Using Dense Gas Fluids to Improve Chemical Processing

We are using dense gas fluids, such as $CO_2$, to improve selectivity, reaction rate and control in durable finishing, morphology modification and coloration processes for fibers. (Drews) [C01-C01]

## Dyeable Polypropylene via Nanotechnology

We are infusing nanoparticles, such as nanoclays modified with quaternary ammonium salt, into polypropylene fibers to create dyesites for lower cost dyeings in apparel fibers. (Fan) [C01-D20]

## Thermally Stable Textile Processing Aids

We are developing a fundamental understanding of the thermal degradation mechanisms of textile processing aids, such as finishes and antistatic and antibacterial additives. (Grant) [C01-S08]

## *Integrated Enterprise Systems*

*Research in systems to enable rapid response, including information technology, computer modeling, management processes, market research, expert systems, customer interactive design and demand-activated, closed-loop production systems.*

## Building Global Brand Image Strategies

We are examining the potential of the Internet as a strategic tool to enhance global brand images and sales for U.S. apparel products and brands. (Forsythe) [I98-A06]

## An Interactive, Web-Based Baby Boomer Panel

By discovering how baby boomers are reacting to the marketplace, we can explore web-based consumer research. (Ulrich) [I98-A07]

## Fitting Preferences of Females

We seek to understand the nuances of fit from the consumer's perspective so we can translate consumer fit preference data into an expert system. (Connell) [I98-A08]

## Simulating Consumer's Apparel Purchases

We are using agent-based simulation to model the formation of a consumer's intent to purchase apparel. (Brannon) [I98-A09]

## Designing Dyes, Chemical Auxiliaries, Polymers, and Fibers

We are using genetic algorithms, neural networks and fuzzy logic with molecular orbital methods to design a variety of dyes, chemical auxiliaries, polymers and fibers. (Sztandera) [I98-P01]

## Fabric Drape Model

We are developing a physically based model of fabric drape that can be used in apparel design including multiple layers of fabrics, two-ply seams and fabrics with stitches. (Govindaraj) [I98-P02]

## Integrated Supply Chain Analysis

We are attacking critical softgoods supply chain integration and decision support problems using fuzzy mathematics and neural network technologies. (Berkstresser) [I98-S01]

## Predicting Textile and Apparel Demand

We are designing consumer demand equations to predict consumer purchases in textiles and apparel. (Suh) [I98-S06]

## Apparel Production Systems to Support Quick Response

We are developing software to understand the role of manufacturing configuration and production planning and control in support of quick response replenishment to retail. (King) [I98-S12]

## New Textile Technologies: Will They Flourish or Perish?

To improve purchasing decisions, we are developing a model to predict how new textile technologies will survive, flourish, diminish and perish versus competitive technologies. (Thomas) [I99-A02]

## When is Domestic Apparel Manufacturing Competitive?

A retailer or manufacturer can now analyze the accuracy of their sales forecast, and determine how much Quick Response Manufacturing is cost-effective. (Warburton) [I99-D16]

## Educating the Educators

We are developing instructional strategies that expand the abilities of textile graduates in the workplace. (Pastore) [I99-P01]

## Information Engineering

We are developing ways to fundamentally enhance the decision effectiveness in textile manufacturing, using the data-to-decision model as a basis. (Hodge) [I99-S10]

## Fabric Design and Analysis System in 3D Virtual Reality

We are developing software to recognize the image and structure of a spun yarn to produce a database that would yield a model to predict fabric structure and performance. (Adanur) [I00-A06]

## Design Preferences of Lead Users

We wish to create a new methodology to track emerging apparel design trends by merging direct input from lead users with data from textile industry personnel. (Seed Project) (Solomon) [I00-A16]

## Haptic Simulation of Fabric Hand

We are developing a virtual reality system that allows users to achieve a virtual sense of touch so they can evaluate a fabric's hand without actually touching it. (Govindaraj) [I00-P08]

## Automated Garment Development from Body Scan Data

We are creating a conceptual model to automatically integrate body scanning data into commercial CAD/CAM software to facilitate garment design, derivation and sizing. (Carrere) [I00-S15]

## Web-Based System to Track How Consumers Express Lifestyles

We are researching how consumer constellation theory allows consumers to jointly express desired lifestyles across product categories, such as apparel and home furnishings. (Solomon) [I01-A21]

## Redefining the Apparel Consumer

Using psychometric techniques (e.g. personality, interests, values), we are developing a stable, precise and relevant measure of consumer types independent of demographics. (Brannon) [I01-A25]

## Virtual Fit Models Via Body Scan Analysis

By fundamentally understanding body scan data, we seek to develop virtual fit models and slopers for mass produced female apparel based on body shape, posture and weight. (Connell) [I01-A27]

## How Common Consumer Emotions Affect Global Retailing

We are developing a model which will incorporate the emotional responses (e.g. excitement, satisfaction) that drive global consumers' behavior when shopping for textiles at retail. (Kim) [I01-A31]

## Design-Oriented Fabric Comfort Model

We are developing a way to measure fabric comfort using structural, fuzzy-logic and psychological modeling. (El Mogahzy) [I01-A32]

## Using Body Scan Data to Improve Garment Fit

By comparing clothed and unclothed body scan data, we are developing ways to design apparel sizing systems to improve garment fit. (Ashdown) [I01-B01]

## On-Line Weight and Shrinkage Control of Cotton Knits

To improve dimensional control during knitting, we are customizing image technology to design a system that measures the fractional space covered by the knitted loop. (Abou-iiana) [I01-P07]

## Fuzzy Forecasting Model for Apparel Sales

We are developing models to forecast apparel sales based on fuzzy logic (e.g. neural networks, genetic algorithms), then later introducing endogenous and exogenous variables. (Frank) [I01-P10]

### Optimal Investment Strategies for Enhanced Productivity

To increase our textile industry's market share, we are defining investment strategies that maximize manufacturing productivity while satisfying dynamic consumer needs. (Christoffersen) [I01-P13]

### B-to-B Collaboration in a Softgoods E-Supply Chain

Using fuzzy math to capture vague and uncertain factors, we are developing models and prototype tools to establish B2B collaboration in the global softgoods E-supply chain. (King) [I01-S01]

### Modeling Thermal Protection of Apparel

For intense heat environments, such as fire, we are developing an analytical model that predicts thermal protection of and heat transfer through industrial and military apparel. (Barker) [I01-S02]

### Constraint Based Coordination of New Product Development

(Winchester) [I01-S09] **Report Not Submitted**

### Emerging Apparel Supply Chain Configurations

Our research will enable the design of manufacturing systems that support the U.S. apparel supply chain, both from a financial and a service viewpoint. (King) [I01-S10]

### 3-D Imaging of Fabrics from On-Line Yarn Data

From on-line yarn measurements alone, we are developing 3-D prediction models for woven and knit quality attributes, such as appearance uniformity and physical properties. (Suh) [I01-S12]

## In This Section



## *NTC Directory:*

***Bios/Photos of Principal Investigators & NTC Staff ..... Bio file***

Biographies for everyone who has ever been an NTC principal investigator include title, institution, academic degrees, experience, research interests, NTC project numbers, E-mail address, telephone number and personal web site address.

## Clemson Management



## Cornell Management

**[The Annual Report is optional for Cornell in 2001]**

# *Discontinued Projects*

The following NTC programs were discontinued because they successfully completed their maximum three-year life span or because other research was of higher priority. For their last report, see the NTC Web site at http://www.ntcresearch.org, the June 2001 ***NTC Research Briefs*** or the November 2000 ***NTC Annual Report***. You may also contact the principal investigators whose phone numbers and E-mail addresses are listed therein or in the NTC Directory. However, several new programs grew out of these projects. See the notes following the listings below, if applicable.

**Modeling Blood Flow Through Vascular Grafts (Dunn) [M98-P2]**

**Development and Experimental Validation of Nonlinear Phenomena for High-Speed Yarn Transport Systems**
**(Goswami with NC State, Univ. of Sydney, Australia) [F97-C05] - see F01-C04**

**Scientific Study of Flock Materials and the Flocking Process (Kim) [F97-D01]**

**Sensory (Kansei) Engineering of Aesthetics in Textile Fabrics**
**(Barker: Seed Project) [F99-S02]**

**Investigation of Flexible Crosslinking Systems for the Retention of Mechanical Strength and Abrasion Resistance in Durable Press Cotton Fabrics (Lickfield with Georgia) [C97-C03] - see C00-C01**

**Fundamentals of Moisture Transport in Textiles: Magnetic Resonance Imaging Studies (Beckham with UMassD) [C97-G31]**

**Finish Film Stability and Its Relevance to Slinging of Spin Finish on a Spinline (Kamath) [C98-P02]**

**Optimizing Dyeing Process Control Through Improved Modeling (Smith) [C99-S02]**

**Consumer Preferences for Apparel and Textile Products as a Function of Lifestyle Imagery (Solomon with Berry College) [I97-A11] - see I00-A16 & I01-A21**

**Real-Time Yarn Characterization and Data Compression Using Wavelets (Jasper) [I97-S01] - see I01-S12**

**A Programmatic Solution to Compress the Supply Chain in Fabric Weaving**
**(Duenas) [I98-P03]**

# *Abbreviations*

**The following abbreviations are not always defined in articles**

Auburn (A): University of Auburn, Auburn AL 36849
Chem Eng: Chemical Engineering
CivE: Civil Engineering
Clemson (C): Clemson University, Clemson SC 29634
Cornell (B): Cornell University, Ithica NY 14853
dpf: denier per filament
ESR: electron spin resonance
Fib: Fiber
Georgia Tech (G): Georgia Institute of Technology, Atlanta GA 30332
IPST or InstPaperSci&Tech: Institute of Paper Science &Technology
ITT: Institute of Textile Technology, Charlottesville VA 22903-4614
LSU: Louisiana State University
MAE: Mechanical and Aerospace Engineering
ME: Mechanical Engineering
M.I.T.: Mass. Inst. of Technology
NC State (N): North Carolina State University, Raleigh NC 27695
NMR: nuclear magnetic resonance
PET: poly(ethylene terephthalate)
PhiladelphiaU (P): Philadelphia University, Philadelphia PA 19144
Poly Sci: Polymer Science
S: University of Sydney, Australia
TAM: Textile and Apparel Management
$[TC]^2$:Textile/Clothing Technology Corp
TE: Textile Engineering
Tex: Textile
TexE: Textile Engineering
TFE: Textile and Fiber Engineering
TFPS: Textile, Fiber & Polymer Science
TRI: Textile Research Institute (Princeton NJ 08542)
UAB: Univ. of Alabama-Birmingham
UC-Davis: University of Calif - Davis
UD: = University of Delaware
UG: University of Georgia
UNC-G: University of North Carolina at Greenville
UMassD (D): University of Massachusetts at Dartmouth, MA 02747
UNL: University of Nebraska at Lincoln
UNO: University of New Orleans
UofPA: University of Pennsylvania
U of Tenn: University of Tennessee
URI: Univ. of Rhode Island