Mechanics of Composite Materials – Spring 2005
CE 521/ME557
Graduate Project

The purpose of this project is to develop a deeper understanding of some aspect of composite materials that either interests you or is related to your research. You may choose the topic, subject to instructor approval.

Most students choose to write some type of research paper. This could be a literature review regarding the current state of research in the selected field. Alternatively, it could be a report presenting a short research project you have conducted regarding some aspect of composite materials. You are also free to suggest alternative kinds of projects.

All reports must be typed, double-spaced, 12 point font. A typical report length is 15-20 pages. Your report may be longer or shorter depending upon your specific project, as long as you successfully demonstrate your understanding of the chosen topic. You are required to properly acknowledge other authors' works, by providing full references (see attached sample). The report must be your own writing. It is not acceptable to copy and insert sections of someone else's work, verbatim, into your paper. You are expected to write, in your own words, your own understanding of the literature you have read.

How to choose a topic? There are some examples of previous and possible topics listed below. Another way to get ideas for topics would be to browse through the titles and abstracts of papers in the composites journals listed below. You may also use one of the e-databases to search for papers on composites research: http://www.clarkson.edu/library/journals/databases.html . Web of Science is an easy to use database.

Below is a list of milestone dates for submitting key items related to your project:

Item	Due Date
Chosen topic	March 3rd
List of primary references	March 24th
Abstract	April 7th
Final paper/project	April 21st

Some topics from prior years:

Composite retrofitting of unreinforced masonry walls
Micromechanics and progressive fracture of a composite laminate
Natural frequencies of cross-ply laminates
Elastic waves in anisotropic media
Use of composite materials in musical instruments
Kink band formation in unidirection fiber composites

Other ideas for topics:

**Carbon nanotube (CNT) reinforced composites
Models/simulations of mechanical behavior of woven fabric composites
Models/simulations of mechanical behavior of braided composites
Buckling driven delamination
Failure of sandwich composite beams
Fracture propagation in composites
Fatigue failure of composites
Vegetable/natural fiber composites
Automotive applications for composites
Structural applications for composites

**This is a new and very important topic in composites research. Topics within this area include manufacture, experimental characterization and computational modeling.

These are just a few ideas – feel free to think of your own!

Resources

The journals listed below should be available electronically at http://www.clarkson.edu/library/journals/ejournals.php .

Cement and Concrete Composites
Composites Part A: Applied Science and Manufacturing
Composites Part B: Engineering
Composites Science and Technology
Journal of Composites for Construction
Journal of Composite Materials
AIAA Journal
Engineering Fracture Mechanics
International Journal of Fracture
International Journal of Solids and Structures
Journal of Applied Mechanics
Journal of Engineering Materials and Technology
Journal of Materials Science

Some other useful journals are listed below.

Composite Structures
Mechanics of Composite Materials
Polymer Composites
Polymers and Polymer Composites
Experimental Mechanics
Experimental Techniques
Journal of Adhesion

Journal of Advanced Materials
Journal of Reinforced Plastics and Composites
Journal of Testing and Evaluation
SAMPE Journal

A list of print (hardcopy) journals is available in the Clarkson Library can be found at: http://www.clarkson.edu/library/journals/print.php . Sometimes it is useful to browse hardcopy journals to get ideas.

Papers from the other journals where Clarkson does not have electronic access or a hardcopy, can be requested via interlibrary loan: http://www.clarkson.edu/library/services/interlibrary.php , however it often takes 2-4 weeks to obtain these papers, so order them early!

Expert from a paper that references other authors' works:

1. Introduction

Strain localization in geological materials occurs at all scales, from intragranular to global. While shear localization has been widely documented and studied for many years, recent field and laboratory examinations of high porosity sandstone have uncovered another localization mode. Mollema and Antonellini [1] identified a deformation structure in Aeolian sandstone that consists of thin planar zones of pure compressional deformation (no shear), which they referred to as "compaction bands." Within these bands, microstructural observations revealed crushed grains and collapsed pores, resulting in significant porosity reduction (surrounding rock porosity was 20-25%, while band porosity was only a few percent).

Subsequently, while conducting axisymmetric compression tests on Castlegate sandstone (28% porosity), Olsson [2] observed zones of localized compaction in some specimens, perpendicular to the maximum stress direction. Similarly loaded specimens exhibited shear bands, and all specimens contained shear bands and/or compaction bands. Later, Olsson and Holcomb [3] used acoustic emission locations to define and track the

location and thickness of compaction bands in Castlegate sandstone. More recently, Wong et al. [4] observed compaction bands and conjugate shear bands in laboratory specimens of sandstones with porosities ranging from 13% to 28%, and Klein et al. [5] reported compaction band formation in Bentheim sandstone (porosity 23%).

References

[1] Mollema PN, Antonellini MA. Compaction bands: a structural analog for anti-mode I cracks in Aeolian sandstone. Techtonophysics. 1996;267:209-228.

[2] Olsson WA. Theoretical and experimental investigation of compaction bands. Journal of Geophysical Research. 1999;104:7219-7228.

[3] Olsson WA, Holcomb DJ. Compaction localization in porous rock. Geophysical Research Letters. 2000;27(21):3537-3540.

[4] Wong T-f, Baud P, Klein E. Localised failure modes in compactant porous rock. Geophysical Reseach Letters. 2001;28(13):2521-2524.

[5] Klein E, Baud P, Reuschlé T, Wong T-f. Mechanical behavior and failure mode of Bentheim sandstone under triaxial compression. Physics and Chemistry of the Earth (A). 2001;26(1-2):21-25.