Distance Learning
CIRE Review, May 2001

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The Mesoscale Interface Mapping Project
Joint FAMU-CMU Course

• Started with a 1 credit-hour (3 units) offering by Brent Adams in 1999 on Texture & Anisotropy. Focused on fundamental topics in the Mesoscale Interface Mapping Project of joint interest between CMU and FAMU/CIRE.

• Expanded to a 2 credit-hour (6 units) course (graduate, with a few undergraduates) in 2000. Taught mainly by Rollett with assistance from Hamid Garmestani and Brent Adams.

• Videoconference hardware provided through CIRE.
2001 activity

- Expanded further to a 3 credit-hour (4 for graduate students) course in 2001. Title is *Advanced Characterization and Microstructural Analysis*. Scope included microstructure in its broadest sense (orientation as well as phase structure), a survey of microscopy, especially electron microscopy, and analysis (e.g. introduction to stereology). Anisotropy also discussed to show examples of the impact of texture.
1. Overview of Microstructural Characterization Techniques
   - Optical Microscopy
   - Electron Microscopy
     - Transmission EM (TEM)
     - Scanning EM (SEM)
   - Atomic Force Microscopy (AFM)
   - Specialty Microscopies: 3D X-ray microscopy
   - Texture Measurement
   - X-ray diffraction (pole figures, Laue)
   - Electron diffraction (EBSD, OIM); geometry of EBSD data acquisition

2. Analysis of Characterization data
   - Stereology
   - Serial sectioning (e.g. alignment of parallel sections)
   - Representation of Texture
   - Mathematical Representations
   - Graphical Representations
   - Crystal, Sample symmetry
   - Discrete vs. Continuous Representations
   - Grain Boundary (misorientation) texture
   - Lattice Curvatures (geometrically necessary dislocations)

3. Calculation of Orientation Distributions (OD) from Projections (pole figures)

4. Structure-Property Relationships
   - Anisotropy: Elastic & Plastic
   - Taylor model for texture development and anisotropy
Other Links

• Collaboration between FAMU/FSU (Garmestani) and Drexel (Kalidindi) prompted inclusion of a link (via WebCast) to the Materials Engineering department at Drexel University.

• Collaboration with Lehigh (Harmer) through PTIA also provided a link.

• Lehigh has multi-point videoconferencing capability (as of late Feb.) which has supported the FAMU-Lehigh-CMU link.
Statistics

- 32 students registered (not including ~4 auditing).

FSU/FAMU
Akin, Yalcin
Bacaltchuk, cristiane
Bennett, Tricia
Brown, Michal
Castellobranco, Gilberto
Edwards, Sean
Jefferson, Gail
Okuyucu, Hasan
saheli, ghazal
Shinholser, Kevin
Su, Jianhua
Thomas, Angela
Vasquez, Andres
Waryoba, Daudi

CMU
Archibald, Wayne
Cheong, Soonwuk
Frederick, Kevin
Gungor, Ali
Liu, Yi-Kuang
mancinelli, chris
Pisula, Scott
ramachandran, gautham

Drexel
Bhattacharya, Abhishek
Lim, Hak
Murugaiah, anand
Salem, Ayman

Lehigh
Claves, Steven
Gorzkowski, Edward
King, Patrick
Rockosi, Derrick
Roos, Laura
VanGeertruyden, William

Distance Learning
Technologies

• Videoconferencing has matured significantly in the last 3 years. What was an unreliable, telephone-based system has become a moderately reliable, Internet-based system.
• Internet-2 vital to successful operation for sustainable high speed links.
• Resolution (NTSC) is not adequate for sustained scientific presentation: students rely on local viewing of Powerpoint/PDF files.
Digital Microscopy Classroom at CMU

- Established in 1998 as part of the J. Earle and Mary Roberts Materials Characterization Laboratory
- 17 workstations (11 UNIX, 6 NT), departmental server
- Lectern touch panel for control of video, sound, document camera, DVD, VHS, and remote instrument control
  - Centralized baseband network for remote control of scientific instruments [TEM, SEM, to be expanded]
- Ethernet-based videoconferencing
- Used for undergraduate lab experiments and demos, graduate level courses
Web Based Tools

• We have used Blackboard extensively.
• Provides a server with extensive tools for exchange of information, assignments, grading.
Course Materials

• The lecture notes are provided in the form of powerpoint (with pdf copies) files.
• Approximately 35 slide sets (~200 Mbytes).
• Readings provided (scanned images).
• Homeworks posted on the server, together with solution sets.
• Email useful for off-line interaction.
• Instant messenger used during class to supplement videoconference links.
Instructors

• Majority of course taught by Rollett; lectures on microscopy by Peter Kalu; guest lecture by Greg Rohrer.

• Field trip by CMU to Alcoa Tech Center to see high-speed pole figure acquisition (Weiland & Fridy).

• Each university handles its own grading (except Lehigh).
Summary

• Course content has provided a basis for strengthening the Florida-CMU collaboration.
• Videoconference technology is adequate; considerable room for improvement in video resolution (bandwidth!) and audio.
• Successful sharing of the course points to a model of specialized courses shared between universities. Materials departments in PA discussing this concept.