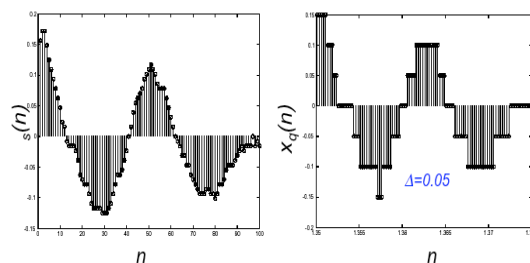


# MAT 200C: Survey of Media Technology and Engineering, Spring 2009

MAT 200C *Survey of Media Technology and Engineering* is a broad survey/reading course that covers topics as diverse as computer architecture and haptics. The goal is to cover all those areas related to multimedia application development that are not covered in the other four MAT core courses. As such, this leaves us with a broad range of both theoretical and practical issues related to multimedia perception, communication and information theory, central processor and computer design, representation of signals and events, networking hardware, signal processing, multimedia input/output interfaces, and applications.

## Course Outline

0. Introduction & review: math, EE, CS, psychology, etc.
1. Topics from electrical and computer engineering
2. Media data, signals, and symbols
3. Data models, representations, and formats
4. Digital manipulation of signals and symbols
5. Media I/O devices
6. Applications in arts, entertainment, and education



## Format

- 2 \* 2 hours/week lectures (Tues/Thurs)
- 1 \* 2 hours/week lab (Time TBD)
- Homework programs, quizzes, development project, final presentation

## Materials

Readings book and presentation slides (both at the UCSB book store)

## Requirements

- 1-2 hours required reading per week: see the reader
- Short (20 minute) topical presentation with advanced readings
- Short (8-10 pages) paper: survey or summary of advanced readings
- Software project: implementation of a program related to the readings

## Instructor

Stephen T. Pope ([stp@mat.ucsb.edu](mailto:stp@mat.ucsb.edu))

## Meeting time and place

Tues/Thurs 2:00 - 3:50 PM; Music 2215

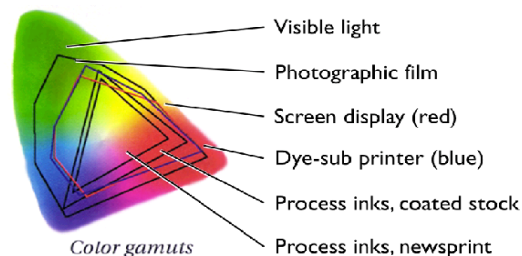
## Electronic Resources

Course Web Site

<http://www.mat.ucsb.edu/200C>

Email Mailing List

<http://lists.create.ucsb.edu/mailman/listinfo/200c> to join



# MAT 200C Reader Contents

## **0. Introduction & Review**

Course introduction and overview  
Reviews of topics from Math, EE, CS, Psychology, etc.

## **1. Some Topics from Electrical and Computer Engineering**

Computer design: system and processor architecture  
Hierarchical memory and the storage pyramid  
High-performance computing  
I/O and Networking  
Advanced software architecture

### Readings

Wikipedia Entries for *Computer*, *Computer Hardware*, *CPU*, *CPU Design*, *Microarchitecture*, *Super-computer*, *Operating System*, and *IEEE 802.11*.  
M. Murdocca and V. Heuring. "Principles of Computer Architecture" (slides from book)  
AMD, Inc. "AMD K6 Processor Multimedia Technology"  
M. Altmann. "Hardware Acceleration for Window Systems." (<http://davis.wpi.edu/~matt>)  
Wikipedia Entries for *USB*, *FireWire* and *MIME*  
L. Alldrin. "Firewire and USB" in Pro Audio Review 12/99  
Bluetooth and Wireless Networking, *JAES* 11/2002  
G. Robertson and D. McAuley. "Sample Rate Sync over an ATM Network" Proc 1997 ICMC

### See also

C. Hand. "CSYS1001 Computer Architecture Notes" (www: De Montfort University)  
J. Pawasauskas. "MMX Technology." (<http://davis.wpi.edu/~matt/courses/cs563/talks/powwie/p3/mmx.html>)  
S. Ball and R. Probin. "An Overview of AltiVec on the PowerPC (Lightsoft)"  
H. Nguyen and L. John. "Exploiting SIMD Parallelism in DSP and Multimedia Algorithms using the AltiVec Technology (www: UT)"

### Software

Compilers, interpreters, scripting languages, operating systems, APIs

## **2. Media data, signals, and symbols**

Overview of Information theory  
Time and dimension in media data signals  
Data quantization and conversion  
Media data: events and streams

### Readings

Wikipedia Entries for *Information Theory*, *Data Compression*, *Codec*, *Audio Compression*, *Image Compression*, *Video Compression*, *Comparison of Audio Codecs*, and *Comparison of Video Codecs and Container Formats*.  
C. Shannon and W. Weaver. "Recent Contributions to the Mathematical Theory of Communication."  
Wikipedia Entries for *Auditory System* and *Visual System*  
G. Garnett. "Music, Signals, and Representations" in "Rep. of Musical Signals"  
R. Dannenberg. "Music Representation Issues, Techniques, and Systems" CMJ 17:3  
G. Wiggins et al. "A Framework for the Evaluation of Music Rep. Systems" CMJ 17:3

### See also

S. T. Pope. "Musical Object Representation" in "Musical Signal Processing" (SZ)

Coding, encryption and compression readings

Software

CSound, SuperCollider schedulers and score languages

SoundHack (format conversion)

GraphicConvertor

### **3. Data models, representations, and formats; data storage and transfer**

Digital representation of sound, image, and media stream

Sound and image data formats

Audio/visual rendering: models of objects, space and light

Real-time and isochronous transfer of media data over networks

Readings

#### **Formats & Languages**

Wikipedia entries for *Audio file format*, *Image file formats*, *Format war*, and *Comparison of high-definition optical disc formats*

F. Harris. "Discrete Techniques" Lecture Slides.

M. Altmann. "About NURBS." (www)

J. Goubeaux. "Color Theory and Digital Color Management." MAT 200C Course paper and presentation slides.

S. Dunn. "Digital Color." (<http://davis.wpi.edu/~matt/courses/color>)

#### **MPEG 2, 4 and 7**

F. Pereira. "New Trends in Video and Image Coding." (www)

Background on MPEG TV Compression (www)

MPEG-1 Data Structures (www)

N. Day. "MPEG-7." XML-Journal

MPEG-Industry.com. "What is MPEG-7?" (www)

See also

[S. T. Pope. "Music Composition and Editing by Computer" in "Music Processing" (AR)]

<http://vivaldi.ece.ucsb.edu/PDF/multimedia.pdf>, <http://vivaldi.ece.ucsb.edu/Netra>

RealAudio/LiquidAudio descriptions (www)

[http://ils.unc.edu/dempsey/other\\_stuff/rfc2045.shtml](http://ils.unc.edu/dempsey/other_stuff/rfc2045.shtml)

Software

MP3/RealAudio/LiquidAudio encoders/players

PBM Tools

### **4. Digital processing of signals and symbols**

Data processing in the time, spectral, spatial, and other domains

Sound analysis/synthesis techniques

Image and video processing and animation

Readings

J. O. Smith. "Physical Modeling Synthesis Update" CMJ 20:2

G. Kendall. "A 3-D Sound Primer" CMJ 19:4

V. Galloway and S. Wilkinson. "Surrounded by Sound" in *Electronic Musician* 12/99

N. Stewart. "Choosing Imaging Sensors for Visible Light." (www)

Photocourse. "The Digital Image and Image Sensor." (www)

POV-Ray Beginning Tutorial ([www.povray.org](http://www.povray.org))

S. Martin. "Animation Tricks." (<http://davis.wpi.edu/~matt>)

See also

DASP refs. MAT240A-F

Persistence of Vision Ray Tracer -- <http://www.povray.org/documents>

OpenGL tutorials  
Supercollider refs

#### Software

Soundhack (analysis/resynthesis), pvoc  
Persistence of Vision Ray Tracer (POV-Ray)  
MSP/Jitter

### **5. Media I/O devices**

Perception, psychology, and media  
Issues of communication theory  
Media data capture and performance  
Transducers for signals, control variables, and events

#### Readings

Wikipedia entries for *Human interface device*, *Computer keyboard*, *Computer mouse*, *Game controller*, *Speech recognition*, and *Motion capture*  
J. Pressing. "Cybernetic Issues in Interactive Performance Systems" *CMJ 14:1*  
M. Kölsch, M. Turk. "Keyboards without Keyboards: A Survey of Virtual Keyboards" *Proc 2002 SIMS Workshop*, UCSB

#### See also

<http://www.cs.monash.edu.au/~dcron/glove>  
Ergonomic I/O devices such as <http://www.tifaq.com>

#### Software

MIDI sequencer SW  
SuperCollider + MIDI + VRML

### **6. Applications of media technology in arts, entertainment, and education**

Composition, arrangement, production, data management  
Interactive hardware/software tools/instruments/installations  
Media content and distribution/dissemination  
New (digital/distributed/interactive) media  
Virtual environments, telepresence, and remote collaboration  
Media data in education

#### Readings

Wikipedia entries for *Scientific visualization*, *Hypertext*, *HTML editor*, *Graphic art software*, *Digital audio workstation*, *Collaborative software*, *Edutainment*, and *MMORPG*  
TOC from [baddesigns.com](http://baddesigns.com)  
TOC from B. Schneiderman's 1993 *Encyclopedia of Virtual Environments* (HITL @ UW)  
G. Wang, A. Misra and P. R. Cook. "Building Collaborative Graphical Interfaces in the Audicle." *Proc NIME 2006*

#### See also

S. T. Pope. "Music Composition and Editing by Computer" in *Music Processing* (AR)  
E. Brandt and R. Dannenberg. "Low-latency Music Software" *Proc 1998 ICMC*  
E. Frecon and M. Stenius. "DIVE: A scaleable network architecture for distributed virtual environments" (<http://www.sics.se/dive/dive.html>)  
J. Young and I. Fujinaga. "Piano Master Classes via the Internet" *Proc 1999 ICMC*  
R. Rowe and E. Singer. "Two Highly Integrated Music and Graphics Performance Systems" *Proc. 1997 ICMC*  
D. Keislar et al. "A Content-Aware Sound Browser" *Proc 1999 ICMC*  
Beatnik Audio Engine Description (Beatnik, Inc.)

# MAT 200C Code Archive

- Lab images, sounds,
- and utilities
- Reference readings
- Student projects

▼	Lab	85 MB
▶	ImageTester	4.5 MB
▶	pbmplus	1.5 MB
▶	Presentations	12.4 MB
▶	Ras_file_Info	131.5 KB
▶	SampleImages	4 MB
▶	snd-utils	84.6 KB
▼	SoundExamples	75.4 MB
▶	CelestialTerrestrialCommuters	7.8 MB
▶	testsamples	40 MB
	FallenAngels_8bit_mu-law.snd	3.5 MB
	FallenAngels_8bit.aiff	3.5 MB
	FallenAngels.aiff	7 MB
	MrDC_8bit_mu-law.snd	3.3 MB
	MrDC_8bit.aiff	3.3 MB
	MrDC.aiff	6.7 MB
▼	Venice_photo	26.8 MB
	scan-16.tiff	656.3 KB
	scan-256.tiff	1.1 MB
	scan-gs.tiff	1.1 MB
	scan.tif	20.3 MB
	scan2.jpg	162.9 KB
	scan2.tiff	3.3 MB
	LabNotes.txt	7.8 KB
	lsf.java	2 KB
	samp_quant.sc	3.6 KB
▼	Refs	166.1 MB
▶	CCS130	14.4 MB
▶	ComOrg	1.6 MB
▶	LispMachines	150 MB
▶	POCA	2.5 MB
▶	UML-BOOST	6.5 MB
▼	Students	332.9 MB
▶	200C-2008-Students	165 MB
▶	MAT200C_2008 Folder	15 MB
▶	Students-2000	6.8 MB
▶	Students-2001	22.3 MB
▶	Students-2002	22.9 MB
▶	Students-2004	70.4 MB
▶	Students-2005	30.1 MB

