

Course Number: CSC 637/737

Course Title: Software Techniques for Computer Music

Number of Credits: 3

Schedule: Three hours of lecture/discussion per week.

Prerequisite: a grade of C or better in CSc 413 or consent of instructor

Catalog Description

Algorithms and software design for digital audio and computer music. Analysis and synthesis techniques. Real-time control and interaction. (Formerly CSC 635.)

Expanded Description

Digital audio basics
Nyquist theorem
Sound file formats

Signal flow graphs
Filters and effects

Fourier analysis
Phase vocoder
MPEG4 Structured Audio
Analysis/resynthesis

Wavetable synthesis
Tuning systems
Additive synthesis
Subtractive synthesis
Karplus-Strong plucked string synthesis
Frequency modulation synthesis

The MIDI standard
Programming with PortMidi API
Interactive music system design
Non-standard controllers
Real-time audio programming with PortAudio API

Course Objectives and Role in Program

The objectives of this course include:

- Teach principles of digital audio and audio formats
- Teach software development for handling a variety of audio/music data
- Teach algorithms for transforming digital audio
- Teach algorithms for spectrum analysis (FFT, phase vocoder)
- Explore classical software synthesis approaches and implementations
- Examine MIDI standard and real-time MIDI programming

Students will work on projects implementing sound effects, simple analysis/transformation/resynthesis, and real-time MIDI parsing, material generation, and control. A self-designed final programming project will integrate many aspects of the course material. For generality, the emphasis is on using low-level APIs that are cross-platform and open source. Competence in audio programming is essential in music applications, game development, digital media development and production, and many web applications.

Learning Outcomes

At the end of this course students will be able to

- Understand and implement digital sound effects
- Develop and use spectrum analyzers
- Implement low-level software synthesis operators
- Implement classical sound synthesis algorithms
- Develop code that works with real-time MIDI streams
- Design applications that integrate music/audio information

Method of Evaluation

Student learning will be evaluated on the basis of

- Completeness and quality of programming assignments
- Grade on two midterm examinations
- Quality of final project

The weight assigned to each element of evaluation will be determined by the instructor of the course on the first day of the class.

Required Textbooks

Elements of Computer Music, Moore, F., Prentice-Hall, 1998

Course notes, Hsu, W. 2006

Modified by: W. Hsu

Last Revision Approved: October 11, 2006