

# MAT 240D - Digital Audio Programming: Sound Synthesis Techniques (Fall, 2007)

The MAT 240 course sequence is a six-part (two-year) practical programming course; it consists of hands-on software development devoted to digital audio and multimedia applications. Students read a selection of papers from the literature, with the emphasis on learning to use and extend the current state-of-the-art programming methods, tools, and programming interfaces. Class assignments involve C/C++/Java programming on Linux, Macintosh, MS-Windows, various plug-in APIs, and other platforms.

In MAT 240D, we will implement a variety of software sound synthesis techniques, starting from traditional additive, subtractive, to non-linear synthesis. Our focus, however, will be on more contemporary techniques such as physical models and granular synthesis. We will explore the internals of several existing synthesis packages and write our own versions of selected techniques in the CSL framework in C++ (<http://create.ucsb.edu/CSL>).

Students are expected to know the basics of digital audio signal representation and processing, and to be proficient in C, C++, or Java (Smalltalk, SuperCollider or LISP are a plus). Grading will be on the basis of in-class participation and programming projects.

### Course Outline

- Sound synthesis and processing background
- APIs and frameworks for digital audio synthesis
- Additive synthesis and the FFT
- Wavetable oscillators and optimizations
- Subtractive synthesis and dynamic filters
- Nonlinear techniques: FM and wave-shaping
- Sample-based synthesis and processing
- Physical models: waveguides and simulations
- Chaos and novel techniques
- Building applications and GUIs

### Instructor

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

### Meeting time and place

- T/Th 11:00 AM - 1:00 PM, Music 2215

### Electronic Resources

- Course Web Site  
See <http://create.ucsb.edu/240>
- Email Mailing List  
See <http://www.mat.ucsb.edu/mailman/listinfo/240> to join

