

**Background reading:** Read chapters 30 and 35 in Gold & Morgan.

**Reading assignment:** “Robust pitch estimation with harmonics enhancement in noisy environments based on instantaneous frequency,” Abe, Koboyashi, Imai, Proc. ICSLP 1996.

<http://www.ee.columbia.edu/~dpwe/e6820/papers/AbeKI96-if.pdf>

Post your comments to Courseworks.

**Practical assignment:** This week you will experiment with sinewave modeling of a musical sound using the sinewave modeling tools from the first part of <http://www.ee.columbia.edu/~dpwe/resources/matlab/sinemodel/>.

- (a) Analyze the piano example `bach.wav`. Notice that the tracks appear in the output matrix from `extractrax.m` in approximately sequential order, and different portions of the sound can be separated by choosing individual rows. Make a time-frequency plot showing the frequencies of the tracks you have extracted.
- (b) What is the fundamental frequency of the first note (actually two notes an octave apart)?
- (c) Resynthesize the first note 2 semitones higher in pitch (A semitone is a frequency ratio of  $2^{1/12}$ ). Make a spectrogram zoomed-in on the appropriate harmonics to confirm the fundamental of your new synthesis.

If you are interested in sinusoidal modeling, you will also like the SPEAR application by Michael Klingbeil.

**Project:** It is less than two weeks until the project proposal presentations on March 10th or 12th. For the presentation, we are aiming for a roughly 10 minute presentation that explains to everyone in the class what the goals and methods of your project will be. I recommend preparing a few slides, although the emphasis is on having interesting and well-thought-through ideas, rather than worrying about slick presentation.

We will have the chance to discuss each presentation in class. Then, all students will grade all presentations on technical content, presentation, and originality/interest, as well as making comments which will be collated and passed on to the presenter (anonymously). Your midterm grade will be 60% based on the average rating given by other students to your presentation, and 40% on an assessment by Mike and I of your comments and feedback for the other students (but not our assessment of your own presentation!).