

**MATH 4355****Mathematics of Signal Representations  
Spring 2013**

- Class:** TuTH 2:30pm-4:00pm, F 154
- Instructor:** Bernhard Bodmann, bgb@math.uh.edu
- TA:** Puchen Liu, puchen79@math.uh.edu
- Office:** PGH 604; T 11:00-12:00pm, W 2:00-3:00pm
- Objectives:** This course covers the mathematical development from Fourier analysis to wavelets, with special emphasis on the conversion of a signal from the analog (continuous) to the digital (discrete) domain and its subsequent reconstruction. The material is interspersed with concrete examples and numerical applications such as experimentation with audio signals.
- Contents:**
- | <i>Topic</i>                                 | <i>Approximate Time</i> |
|--|-------------------------|
| Inner product spaces, least squares          | 2 weeks                 |
| Fourier series (FS)                          | 2 weeks                 |
| Fourier transform (FT)                       | 1 week                  |
| Classical sampling theorem                   | 1 week                  |
| Decay and smoothness, uncertainty principle  | 1 week                  |
| Discrete Fourier transform                   | 1 week                  |
| Denoising, oversampling, aliasing            | 1 week                  |
| Haar wavelet                                 | 1 week                  |
| Multiresolution analysis                     | 2 weeks                 |
| Data compression, singularity detection      | 1 week                  |
| Multidimensional digitization and processing | 1 week                  |
| Signal analysis in practice                  | 1 week                  |
- Prerequisites:** MATH 2433 and one of MATH 2331 or MATH 3321, covering calculus and elementary linear algebra. Some familiarity with a programming language is recommended. Part of the assignments requires the use of Matlab.
- Text:** Albert Boggess and Francis J. Narcowich, "A First Course in Wavelets with Fourier Analysis", 2nd edition, Wiley, 2009.
- Midterm Exam:** Thursday, March 7, 2013, 2:30 - 4:30 pm. Room to be announced.
- Assignments:** You will be asked to hand in approximately ten assignments, which will be due on Thursdays in the lecture. Solutions will be posted online.
- Final Grade:** Final exam contributes 50%, midterm 25%, assignments 25%. All grades are summed and divided by the total number of points you can collect in the course. A percentage of 46% or more is D-, 54% or more is D, 62% or more is C, 70% is B-, 77% is B, 85% or more is A-, of 90% or more is A.

**Course Policy:** Students are expected to know what constitutes academic integrity. They are expected to avoid committing academic offenses, and to take responsibility for their actions. Students who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism or cheating) or who would like to learn about rules for group work should seek guidance from the course instructor, teaching assistant, academic advisor, or the Undergraduate Associate Dean. Students who feel that they have been wrongfully or unjustly penalized have the right to grieve.

**Disabilities:** The Center for Students with Disabilities, located in CSD Building #568, Room #110, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the CSD at the beginning of each academic term.