

**MATH 4355**  
**Mathematics of Signal Representations**  
**Fall 2007**

- Class:** MW 5:30pm-7:00pm, AH 301
- Instructor:** Bernhard Bodmann, bgb@math.uh.edu
- Office:** PGH 636; TW 2:30-3:20
- 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 2431 and one of the following: MATH 3333, MATH 3334, MATH 3330, MATH 3363. MATH 3321 can be used instead of MATH 2431. Students may attempt the course without having one of the above junior-level courses but they first have to obtain the consent of the instructor.
- Text:** Albert Boggess and Francis J. Narcowich, "A First Course in Wavelets with Fourier Analysis", Prentice Hall, Upper Saddle River, 2001.
- Midterm Exam:** Monday, October 22, 2007, 5:30 - 7:30 pm. Room to be announced.
- Assignments:** You will be asked to hand in approximately ten assignments, which will be due on Wednesdays in the lecture. Solutions will be posted online.
- Final Grade:** Final exam contributes 60%, midterm 20%, assignments 20%. 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.