EE 60671: Advanced Digital Signal Processing

Instructor: Prof. Martin Haenggi, 274 Fitzpatrick, mhaenggi@nd.edu
Lecture: TR 03:55-05:10pm, 205 DBRT
Textbook: J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 4th Ed., Prentice Hall, 2006.
Grading: 15% homework, 35% midterm, 50% final exam.

Tentative Course Outline

1. **Discrete-time Signals and LTI Systems (Chapters 1–5, 7, 8; Sec. 12.1).**
   Convolution and correlation; random signals; linear time-invariant systems; transforms.
2. **Sampling and Finite-precision Effects (Chapter 6).**
   AD/DA; aliasing; quantization; oversampling.
3. **Filter Design and Filter Structures (Chapters 9, 10).**
   FIR and IIR filter design; implementation.
4. **Multirate DSP (Chapter 11).**
   Interpolation and decimation; filter bank design; polyphase structures.
5. If there is time: **Optimal Filtering of Random Signals (Chapters 12,13).**
   Prediction; Wiener filters; LMS and RLS adaptive filters

Other Resources

- M. Vetterli, J. Kovacevic, and V. K. Goyal, *Foundations of Signal Processing*, Cambridge, 2014. This book uses a geometric approach to signal processing, where signals are interpreted as vectors in Hilbert spaces. It is available at http://fourierandwavelets.org/.
- P. Prandoni and M. Vetterli, *Signal Processing for Communications*, EPFL Press, 2008. This book uses a less formal (more conceptual) approach and is more application-driven. It is available at http://www.sp4comm.org.

Other Information

- The university honor code applies. You may collaborate on homework but you must hand in your own work. Consulting the textbook's solution manual is explicitly forbidden.
- It is assumed that you have had a standard undergraduate-level course on digital signal processing, which (roughly) covers Chapters 1–5, 7, and 8 of the textbook.
- Office hours are "open", which means that you can send me an e-mail and I will make time for you as soon as possible.