Texas A&M University, Department of Mathematics, Spring 2021

MATH 667 (600) — Foundations and Methods of Approximation*

Hybrid, TR 3:15pm-4:30pm, Architecture Building C, Room 111

Instructor: Simon Foucart, 502D Blocker Building, foucart@tamu.edu
Office hours: T 2:15-3:00pm, W 8:30-9:15am, and by appointment
Course web page: see `www.math.tamu.edu/~foucart/#teaching`
Textbook: None required, as concise lecture notes will be made available. Nevertheless, the following books provide additional reading:

- *Constructive Approximation*, by R. DeVore and G. Lorentz.
- *A Course in Approximation Theory*, by E. Cheney and W. Light.
- *Approximation Theory and Approximation Practice*, by L. Trefethen.
- *Scattered Data Approximation*, by H. Wendland.

Course Description: Approximation Theory examines faithful and efficient representations of complicated functions by simpler ones. In this course, we take a tour through this venerable field, from the foundational results about linear approximation (e.g by polynomials) in the univariate setting to modern methods of nonlinear approximation (e.g. by neural networks) in the multivariate setting. An eye will always be kept on computational issues.

Course Content: The following topics will (tentatively) be covered:

- General theory of best approximants
- Chebyshev spaces and interpolation
- Approximation by linear operators
- The Chebfun software
- Direct and inverse theorems
- Rational approximation
- Spline functions
- Data-fitting with radial basis functions
- Wavelets and Besov spaces
- Neural network approximation

*this syllabus is a general plan for the course; deviations announced in class may be necessary

Course Requirement: The course is accessible to Mathematics, Engineering, and Computer Science students alike. It assumes some basic knowledge of linear algebra, analysis, and probability. Familiarity with MATLAB is a plus.

Grading: Based on class participation and homework.

Attendance Policy: Attendance is not compulsory, but regular attendance is expected — it is in fact essential if you want to do well in the course. Classes to be missed due to religious holidays must be communicated to me during the first week. You are required to arrive on time and stay the length of the class. If you do not attend a class, you are responsible for any announcement made, any material covered, and any additional topic introduced during this class. Office hours cannot be used for this purpose.

Electronic Etiquette: Laptops and tablets are not allowed (unless it is demonstrated that they are used for note-taking only). Cell phones must absolutely be put on silent mode, left closed, and put away. If you have a family emergency and need to take a call during class, I shall be notified in advance so that a special arrangement can be made.

Academic Honesty: *"An Aggie does not lie, cheat, or steal or tolerate those who do."*
See `http://aggiehonor.tamu.edu` for more information.

Americans with Disabilities: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information, visit `http://disability.tamu.edu`.