Math 396T: Spring 2020
Elementary Fourier Analysis
Robert Sims

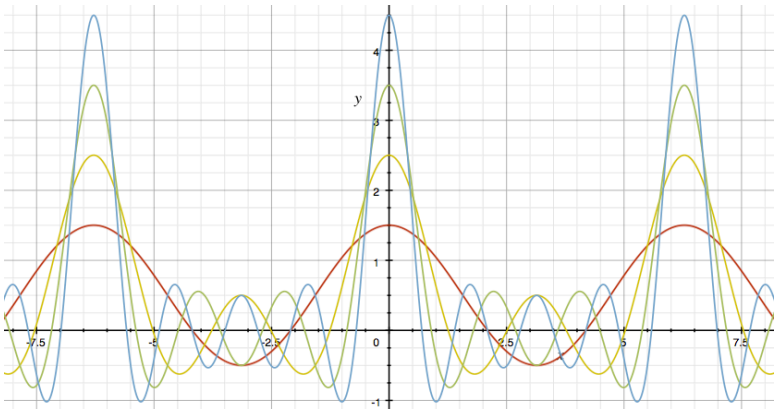

Figure 1: Some Dirichlet Kernels

About the Course: In mathematics, we can often solve hard problems by breaking them up into a sum of much easier ones. Fourier Series were invented to solve important problems like the measuring of heat as a function of time and position, the propagation of waves (light or sound), and the behavior of electrical signals pulsing through circuits or wave-guides. It is remarkable that we can decompose nearly arbitrary signals as the sum of sines and cosines at different frequencies, although we may need to make these sums infinite. In this course we will learn how and when these decompositions can be made. Students need only have a good background in calculus in order to enroll in this course.

Prerequisites: The pre-requisites for this course are Calculus through Math 129.

Text: For this course, I will be using: *Early Fourier Analysis* by Hugh L. Montgomery. Volume 22 in *Pure and Applied Undergraduate Texts: The Sally Series*. American Mathematical Society 2014. Another good undergraduate text on Fourier analysis is: *Fourier Analysis and Its Applications* by Gerald B. Folland. Volume 4 in *Pure and Applied Undergraduate Texts: The Sally Series*. American Mathematical Society 1992.

Objectives: The aim of this course is to provide a gentle introduction to harmonic analysis which begins with various facts about complex numbers and proceeds to develop Fourier analysis touching on a wealth of applications. Students will learn more about the machinery developed in calculus and hopefully better appreciate how notions of convergence arise in problem solving. The course will focus on calculations, understanding and applying theorems, and elementary proof writing.

Expected Learning Outcomes:

- Be able to present and discuss basic notions of analysis in a clear way with careful definitions and some proofs.
- Be able to describe several theorems on convergence of Fourier series especially in reference to smooth functions.