

Dresden Memorial Lecture Series

Swarthmore College



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- Monday, April 13

The Gibbs Phenomenon: a 100 year adventure

When we try to approximate a function using waves—like sines and cosines—we expect that adding more and more waves will give a better and better match (much like how adding more and more polynomials can give a better fit). Surprisingly, this is not always the case! Near sharp jumps or edges, the approximation develops ripples that persist no matter how many waves we include. This puzzling behavior, now known as the Gibbs phenomenon, was first noticed in the 1800s, and was the subject of a spirited discussion in a letter to Nature in 1898.

In this talk, we will explore the history of the Gibbs phenomenon. We will try to understand why these oscillations occur and what they tell us about the limits of representing complicated signals using smooth building blocks. Along the way, we will connect this phenomenon to familiar ideas such as image compression, audio signals, and the appearance of ringing artifacts. We will then discuss how mathematicians have learned to reduce or control these oscillations. This talk requires no specialized background and aims to give an intuitive understanding of a phenomenon that sits at the intersection of mathematics, science, and everyday technology.

- Tuesday, April 14

Strong stability preserving methods for time-dependent problems

When solving time-dependent problems on a computer—especially those involving sharp changes like shock waves or steep gradients—we want numerical methods that behave in a stable and reliable way. Strong stability preserving (SSP) Runge–Kutta methods are designed to do exactly this: they help ensure that important features of the solution, such as avoiding spurious oscillations, are maintained as the computation moves forward in time.

In this talk, we will introduce the basic ideas behind SSP methods and explain why they are useful in practice. We will also discuss some of the challenges in designing these methods, including limitations on how accurate or efficient they can be. Finally, we will give a broad overview of different types of SSP methods and how they are used, highlighting both what is currently possible and what questions remain open. The goal of this talk is to provide an intuitive understanding of SSP methods and help students see how modern numerical analysis tackles real computational problems. This topic will be accessible to anyone who has taken Calculus and seen a differential equation.

Monday, April 13 & Tuesday, April 14

4:15pm Refreshments, 4:30pm Lecture

Science Center 101, Chang Hou Hall Tiered Classroom