Gibbs Phenomena: What has happened to Eeyore’s Tail?

Dr. Lidia Bloshanskaya

Remember the last time you tried to figure out the details in a small JPEG file you found somewhere on the Web? If the picture is highly compressed, you’ll see “halos”: hazy and blotchy artifacts around the edges and the sharp color transitions. But it will be clear in the areas with no change of color.

These “halos” are called *ringing artifacts* that happen at the sharp transitions of data values (in this case color). The math behind JPEG compression is a *Fourier series*, a way to decompose a function in an infinite sum of simply oscillating waves, sines and cosines. For the piecewise continuous function the Fourier series converges providing a good tool for approximation of complicated functions. However near the jump discontinuities (sharp color transitions) the Fourier series exhibits a persistent overshoot or undershoot of the values, resulting in the oscillations near the jump. This causes the “halos”. This effect was mathematically described by Willard Gibbs in 1899 and bears the name of *Gibbs phenomena*.

We will talk about Fourier series in general, Gibbs phenomena and its consequences in the technology (and in our life). You’ll be totally fine with the background in Calculus 2 and might even survive with just Calculus 1.

Join us in enjoying some fun math, delicious cookies and lots of pictures (and even movies) on September 30th, Wednesday, 11:00 - 12:00 in FOB S14.