

About the Cover

This month we honor 2017 Steele Prize Lifetime Achievement winner James G. Arthur.



One of Arthur's main research interests is in harmonic analysis, a broad mathematical area with origins in the analysis of periodically recurring phenomena. Inspired by his research, this month's cover features the harmonic components of the sound waves produced by a piano playing an excerpt from Bach's *Gott sei uns gnädig und barmherzig* (BWV 323)–1725.¹

Of harmonic analysis in music and mathematics, Arthur once wrote:²

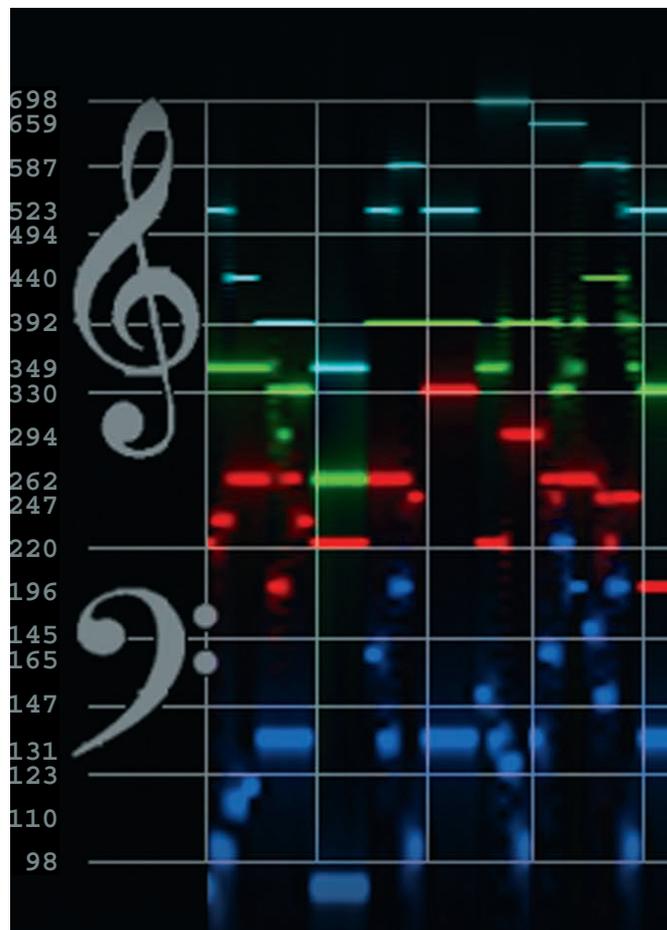
“Harmonic analysis in music is the study of chords, and of how they are used in combination to create musical effects. Harmonic analysis in mathematics takes on a somewhat different meaning. It too has roots in music, or at least in the mathematical analysis of sound. However, the term can also mean a kind of universal duality that runs throughout mathematics.

Different musical instruments make different kinds of sound, even when they play the same note. The analysis of this phenomenon can be very complicated, but to a first approximation, it is the shape of the instrument that determines the sound it creates. Shape is an obvi-

ous geometric property. Sound is an example of what is often called a spectral phenomenon... . We thus have an example of something geometric—the shape of a musical instrument—which corresponds to something spectral—the sound produced by the instrument. Harmonic analysis in the broadest sense refers to a general principle in mathematics that links geometric objects with spectral objects... .”

Photo Credit

Photo of James G. Arthur receiving the Steele Prize from Robert L. Bryant courtesy of Asif Ali Zaman.



¹This imagery is in the public domain.

²www.claymath.org/library/cw/arthur/pdf/hainMath.pdf