ENGINEERING AND MUSIC
Organizers: Daniel P. W. Ellis, Columbia University; Youngmoo E. Kim, Drexel University

Music plays a vital role in every culture on Earth, contributing substantially to the quality of life for billions of people. Engineering and technology have strongly influenced music since the first musical instruments, and the power and potential of this relationship is exemplified by the work of great multidisciplinary thinkers, such as Leonardo Da Vinci, Benjamin Franklin, and Alexander Graham Bell, whose innovations were inspired by their passions for both fields. The past decade has seen a revolution in the aggregation of enormous digital music libraries, the use of portable digital devices to listen to music, and the ease of digital distribution. Similarly, there has been tremendous growth in the accessibility of advanced tools for music creation, manipulation, and interaction. These forces are in the process of reshaping the music industry, moving well beyond the sale of recordings into such areas as personalized music search and retrieval, fan-generated remixes and "mash-ups", and interactive video games.

The rapid proliferation of digital music has given rise to an explosion of music-related information, and the new field of music information retrieval seeks methods for managing this data. Future music listening will be transformed with systems able to locate, from among a virtually unlimited pool of available music, items fine-tuned to satisfy the mood and preferences of a listener at that moment. To reconcile quantitative signal content with the complex and obscure perceptions and aesthetic preferences of listeners, this field must involve an unprecedented collaboration between signal processing, machine learning, data management, psychology, sociology, and musicology. Brian Whitman (co-founder of The Echo Nest, a company focused on very-large-scale music information retrieval) will present some of the latest advances in the field, combining audio features and myriad music-related data sources to computationally derive metrics for such complex judgments as artist similarity and personalized music recommendations.

The next speaker, Douglas Repetto (Director of Research, Computer Music Center, Columbia University) is the founder of DorkBot, a collection of local groups of people using technology in non-mainstream ways, which usually fall into the category of art for want of a better name. He will talk about his own use of technology for music, and about his wider experience and views of the ways that people in the "maker" community are practicing what is clearly engineering, but outside of the traditional engineering institutions.

Engineering advances have transformed the creative palette available to composers and musicians. Sounds that cannot be produced using physical instruments can be generated electronically, and modern laptop computers have sufficient processing power to perform complex synthesis and audio transformation operations. The application of these technologies in collaborative live performance has been pioneered by the Princeton Laptop Orchestra (PLOrk), co-founded by Dan Trueman (Associate Professor of Music at Princeton). His presentation will detail the technologies used and developed by PLOrk, and the orchestra's ongoing efforts in using music technology to engage and energize undergraduate and K-12 students.

The relationship between music and mathematics has long-been a topic of fascination. From the ancient Greeks, who considered music to be a purely mathematical discipline, to the serialist composers of the 20th century, who relied purely on numeric combinations to drive compositional choices, there have been countless attempts to derive and define a formal relationship between the two fields. Elaine Chew (Associate Professor of Industrial and Systems Engineering at the University of Southern California) will present her work, which uses mathematics to analyze and better understand music, incorporating mathematical representations into visualizations for live performance.