

## Crossing the boundaries

Maria Emelianenko, *George Mason University, Fairfax, VA*

My journey has taught me that there are tremendous opportunities to be gained in crossing the boundaries and venturing beyond the safety and comfort of familiar things. The first boundary I crossed was the US border when I came to US for graduate studies in Mathematics. Working on my degree, I came to know amazing mathematicians and scientists who worked together on solving long standing challenges on the boundary between mathematics and materials science. In my thesis I ended up connecting these disciplines by developing accurate algorithms for detecting phase transitions in physical systems and optimizing point distributions for a variety of applications. This work and the career path that I followed led to a variety of interesting collaborations and stimulating encounters that fostered my intellectual curiosity and forced me to learn about things that lie on the boundaries between sciences, fields and conventional paradigms. In this talk, I will give examples of these often overlooked connections that make the interdisciplinary mathematics so fascinating. I will talk about the ways in which grain boundaries within polycrystalline materials influence material performance, and how it is in fact similar of the way in which the structure of protein networks impacts adaptation mechanisms within biological systems. I will talk about entropy as a measure of disorder, but also as a measure of closeness between datasets, images and random structures. Last but not least, I will share some comments on how the same concepts appear in the context of quantum computing, one of the most exciting frontiers of modern science.



**Bio:** Maria Emelianenko is a Professor and Chair of the Department of Mathematical Science at George Mason University. She graduated with a PhD in Mathematics from Pennsylvania State University and held a postdoctoral research associate position at the Center for Nonlinear Analysis of Carnegie Mellon University before joining Mason faculty. Her work lies at the interface between mathematics and other areas of science and engineering, such as materials science, chemistry and biology. Emelianenko's work has been supported by a number of National Science Foundation (NSF) grants, including the 2011 NSF CAREER award. She is

a recipient of the 2009 ORAU Ralph E. Powe Junior Faculty Enhancement Award and 2008 MAA Project NExT Fellowship. She is serving as a and an Associate Director of the Quantum Science and Engineering Center and has co-directed several outreach and undergraduate research programs, including the first NSF-funded REU SITE at Mason. She is currently a Vice Chair of the SIAM Activity Group in Materials science and a SIAM representative to the US National Committee for Theoretical and Applied Mechanics.