Dr. Athanasios Tzavaras

King Abdullah University of Science and Technology
Saudi Arabia

Athanasios Tzavaras is a professor at the King Abdullah University of Science and Technology (KAUST), Saudi Arabia. He obtained a Diploma in Naval Architecture and Marine Engineeratg in 1981 from the National Technical University of Athens, Greece, and received a Ph.D. in Applied Mathematics in 1985 from Brown University. He held academic positions at the University of Wisconsin-Madison from 1987 to 2005, the University of Maryland from 2005 to 2009, and the University of Crete, Greece, from 2002 to 2004 and from 2010 to 2014. He is a fellow of the European Academy of Sciences. He is a member of the American Mathematical Society (AMS), the Society of Industrial and Applied Mathematics (SIAM), and the International Society for the Interaction of Mechanics and Mathematics. He is an Associate Editor of various journals and a Corresponding Editor for the SIAM Journal on Mathematical Analysis.

Title: Oscillations in hyperbolic-parabolic systems and homogenization via kinetic equations

Abstract:
We present examples of sustained oscillations for hyperbolic-parabolic systems. In the existence theory for viscoelasticity of Kelvin-Voigt type, oscillations on the deformation gradient
can persist and propagate in time. The existence of sustained oscillations is demonstrated in two classes
of systems: (i) Examples from nonlinear viscoelasticity with elastic strain energy that is not rank-1
convex, and (ii) in the compressible Navier-Stokes system with non-monotone pressures.
The subject naturally leads to the problem of deriving effective equations for the associated homog-
enization problems. This problem is addressed using ideas from the kinetic formulation for conservation

laws. One derives homogenization equations for oscillations of the density in one-dimensional models
of viscoelasticity with non-monotone stresses and also for the compressible Navier-Stokes system with
nonmonotone pressures. This leads to effective systems consisting of kinetic equations coupled with the
macroscopic flow.