<u>Citation for Gui-Qiang G. Chen (Pólya Prize)</u>

Short citation

Professor Gui-Qiang G. Chen of the University of Oxford is awarded the Pólya Prize for his deep research into nonlinear partial differential equations, and in particular his rigorous theoretical analysis of the equations of gas dynamics, especially those involving transonic flows.

Long citation

Professor Gui-Qiang G. Chen of the University of Oxford is awarded the Pólya Prize for his deep research into nonlinear partial differential equations (PDEs), and in particular his rigorous analysis of the equations of gas dynamics, especially those involving transonic flows. These are extraordinarily difficult PDEs, for which very few exact solution formulas exist. Rather, rigorous analysis depends upon deriving subtle entropy and energy estimates and establishing compactness criteria for sequences of approximate solutions. Professor Chen is an absolute master of these techniques.

Much of Chen's research concerns compensated compactness techniques. The problem here is to understand the structure of the Young measures that record possible wild oscillations for sequences of approximate solutions. The key insight, due originally to Tartar and DiPerna, is that appropriate entropy-type inequalities can provide (just barely) enough information to deduce the strong convergence of approximate solutions for many systems in gas dynamics, even with shock formations. In early work with his advisor Xiaxi Ding, Chen used compensated compactness to prove the convergence of the Lax–Friedrichs and Godunov schemes for the equations of isentropic gas dynamics through the analysis of the degenerate Euler–Darboux–Poisson equation. Chen's paper with Dafermos, Slemrod, and Wang establishes the sonic limit of subsonic flows around, say, an airfoil, and his recent papers successfully attack all sorts of related nonlinear problems in fluid dynamics and even geometry.

In addition, Chen (with Feldman) has carried out an extensive research program on multidimensional shock waves, with emphasis upon shock reflections and transonic flows. When a planar shock wave hits a wedge, a reflected shock moves outward and various patterns of reflected-diffracted shocks may also appear. von Neumann conjectured various conditions for the existence of regular reflections and for transitions between other types of reflections, depending on the wedge angle. For potential flows, Chen and Feldman proved the so-called "von Neumann detachment conjecture" in various situations, and they also analysed more complicated possibilities for strong shocks. Their book "The Mathematics of Shock Reflection–Diffraction and von Neumann's Conjectures", in the Princeton *Annals of Mathematics Studies,* recounts this work.