Prof Howard Stone is the Donald R. Dixon ’69 and Elizabeth W. Dixon Professor in the department of Mechanical and Aerospace Engineering at Princeton University. Professor Stone's research interests are in fluid dynamics, especially as they arise in research and applications at the interface of engineering, chemistry, physics, and biology. He is a very distinguished researcher in fluid dynamics including being the first recipient of the G.K. Batchelor Prize in Fluid Dynamics in 2008.

Abstract:

In this presentation I will discuss various multiphase flow problems that we have studied in recent years. These problems have often appeared when working with colleagues in different disciplines. New questions were generated but then were realized to have some relation to classical multiphase flow problems in fluid mechanics. Thus, I will discuss: (i) The “Bretherton” problem concerns a long bubble translating in a close-fitting, liquid-filled tube. We show via experiments and theory that, for the case of a bidisperse suspension, a bubble, which is separated from the wall by a thin film, acts as a speed-dependent filter to separate the small and large particles. (ii) A spherical particle translating at low Reynolds numbers (slow flows) parallel to a rigid wall maintains the same separation distance during its motion. We show using theory and experiments that a particle moving along an elastic membrane, which can deform by bending, is repelled from the membrane due to hydroelastic forces. (iii) Thermal gradients in fluid systems can lead to the formation of distinct layered patterns. We report experiments injecting a hot fluid into a second, similarly hot, miscible phase and show that, above a critical injection velocity, layering emerges over a time scale of minutes; the same phenomenon can occur in café latte. At the heart of each of the problems mentioned above are classical ideas in mechanics.