Well-posedness of the KdV-KS equation on a finite interval

Chris Mayo

University of Kansas

The Korteweg-de Vries Kuramoto-Sivashinsky (KdV-KS) equation is a fourth-order nonlinear evolution equation with a KdV-type nonlinearity. The traditional KS equation serves to model a variety of phenomena, such as disturbances in laminar flame fronts and widths of liquid films as they run down a surface. The KdV-KS equation includes a linear third derivative term in addition to the second and fourth found in KS, with a relative strength that acts as a parameter of the problem. In the liquid film example, this parameter allows the modeler to account for inclination in the surface, such as in the case of rain running down a smooth roof.

In this talk, we consider the initial-boundary value problem for the one-dimensional KdV-KS on the finite interval. We establish the local well-posedness of this problem in the sense of Hadamard (existence and uniqueness of the solution as well as its continuous dependence on the data) for initial data in the Sobolev space H^s and boundary data in suitable Sobolev spaces determined by the regularity of the initial data and the KdV-KS equation. A foundational element of our proof is the linear solution operator derived through the unified transform of Fokas, from which we extract a wide variety of linear estimates. Combining these with certain nonlinear estimates, we manage to show well-posedness all the way down to negative-order Sobolev spaces.