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Cable knot solutions of the vortex filament flow

A naïve model of vortex filament motion in an ideal fluid leads to an integrable geometric evolution equation for curves in Euclidean 3-space known as the vortex filament flow (VFF). Solutions of the flow are related to solutions of the cubic focussing nonlinear Schrödinger (NLS) equation via the well-known Hasimoto correspondence. In particular, algebro-geometric techniques for constructing finite-gap NLS solutions can be adapted to generate VFF solutions associated to a given hyperelliptic Riemann surface.

In this talk, I will discuss joint work with Annalisa Calini, describing how to generate a family of closed VFF solutions of increasing topological complexity via successive deformations of the associated Riemann surface. Beginning with a circle, we prove that every step in the deformation sequence corresponds to constructing a cable on previous filament; moreover, the knot type of the filament can be read off from the data generating the deformations.