

Poincare Indices of Rheoscopic Visualisations

M. Wilkinson, V. Bezuglyy, and B. Mehlig

Abstract

Suspensions of small anisotropic particles, termed 'rheoscopic fluids', are used for flow visualisation. By illuminating the fluid with light of three different colours, it is possible to determine Poincare indices for vector fields formed by the longest axis of the particles. Because this vector field is non-oriented, half-integer Poincare indices are possible, and are observed experimentally. An exact solution for the direction vector appears to preclude the existence of topological singularities. However, we show that upon averaging over the random initial orientations of particles, singularities with half-integer Poincare index appear. We describe their normal forms.