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Control of ferrofluid jets with magnetic fields[1] ROMAIN CANU, MARIE-CHARLOTTE RENOULT, Normandie Univ, UNIROUEN, INSA Rouen, CNRS, CORIA — A linear stability analysis of a Newtonian ferrofluid cylinder under a steady magnetic field with a general shape is performed. Surrounding fluid and gravity effects are ignored and isothermal axisymmetric conditions are considered. The admissible magnetic field shapes are found with a radial dependence for the radial and azimuthal components and a constant axial component. A dispersion relation is obtained and an equation for the cut-off wavenumber is developed. They are solved for different magnetic field shapes and the applicability to jet experiments is studied by linking the spatial and temporal analysis of the jet. The stabilizing effect of the axial and azimuthal shapes, already reported in the literature for the inviscid case, is retrieved. The influence of a solenoid or a wire, that can be used to create experimentally these fields, is also quantified. Above all, the wire is employed to prevent the singularity at the cylinder center due to the radial dependence. In addition to these two cases, a magnetic field with a destabilizing effect is sought. We show that a radial shape is one solution. Such ability to control ferrofluid jets with magnetic fields could be of interest for applications in the printing and medical fields.

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