Abstract Submitted
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Oscillatory magnetoconvective instability in a ferrofluid layer placed in an oblique external magnetic field SERGEY A. SUSLOV, HABIBUR RAHMAN, Swinburne University of Technology, Australia, ALEKSANDRA A. BOZHKO, Perm State National Research University, Russia — Magnetite-based ferrofluids are manufactured magneto-polarisable nanofluids that magnetize in an external magnetic field in a similar way to natural paramagnetic fluids(e.g. oxygen), however to a much higher degree. Paramagnetic and ferrofluid flows are described by similar equations and it is expected that they would exhibit a similar behaviour. Indeed we show that in both type of fluids the most prominent instability structures align with the in-layer field component and the onset of magnetoconvection is delayed by the field inclination. However we find that in contrast to paramagnetic fluids the instabilities arising in differentially heated ferrofluids placed in a uniform external oblique magnetic field are oscillatory. This is traced back to the nonlinearity of the magnetic field distribution induced inside the ferrofluid layer that arises whenever the direction of the applied magnetic field is not normal. Given that the magnetic field inclination with respect to the plane of the layer is inevitable near its edges the obtained stability results shed light on the possible reasons for the existnce of unsteady patterns that have been detected in the normal field experiments we reported previously.

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