Notice for the PhD Viva Voce Examination

Ms Neha Aanam A (Reg. No. 1650087), PhD scholar at CHRIST (Deemed to be University), will defend her PhD thesis at the public viva-voce examination on Monday, 27 September 2021 at 2.00 pm in the Syndicate Room (Room No.802), Ground Floor, Auditorium Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Instabilities in Ferrofluids with Temperature and Magnetic Field Dependent Viscosity under Different Modulations**
Discipline	:	**Mathematics**
External Examiner (Outside Karnataka)	:	**Dr S Sreenadh** Professor Department of Mathematics Sri Venkateswara University Tirupathi – 517502 Andhra Pradesh
External Examiner (Within Karnataka)	:	**Dr Vanishree R K** Professor and Head Department of Mathematics Maharani Cluster University Bengaluru - 560001 Karnataka
Supervisor	:	**Dr Smita S Nagouda** Associate Professor Department of Mathematics School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

The members of the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva.

Registrar

Place: Bengaluru
Date: 22 September 2021

ABSTRACT

There has been a vigorous effort by researchers to study and characterize Rayleigh–Bénard convection in ferrofluids owing to their interesting applications. From the survey of the literature pertinent to the problems under consideration in our study we realize the importance of using variable viscosity and thus explore the dynamics of a ferrofluid with temperature and magnetic field dependent viscosity which is in a Rayleigh- Bénard situation. The system under consideration is subjected to external constarints viz., an imposed time-periodic body force, rotation speed modulation, temperature modulation and magnetic field modulation. The problem considers both sinusoidal and non-sinusoidal time-periodic variations of these modulations to study the onset and post-onset regimes of Rayleigh-Bénard ferroconvection. We perform a weakly non-linear stability analysis using a truncated Fourier series representation and arrive at the Lorenz system for ferrofluid convection with variable viscosity. By using the linearized form of the Lorenz system we arrive at the critical Rayleigh number to study the onset of ferroconvection under different modulations. The heat transport is quantified in terms of the time-averaged Nusselt number and the effects of various parameters on it are studied.

In our study we find that the thermorheological effect and the magnetization effect work in unison to destabilize the system while the magnetorheological effect stabilizes the system. The influence of the parameters on the heat transport is opposite to their effect on the critical Rayleigh number. The effect of modulated gravity, rotation and magnetic field is found to have a stabilizing effect on the onset of ferroconvection while thermal modulation destabilizes the system. It is also found that the square waveform modulation facilitates maximum heat transport in the system due to advanced onset of ferroconvection. The results, discussions and thereby the conclusions drawn in our study are in agreement with the works by other authors for the limiting cases as discussed in the thesis.

Thus, viscosity being one of the important transport properties for designing heat transport devices, this study which emphasizes the effect of rheological effects can be efficiently used to control the heat transport rates. Also, the magnetization of these ferrofluids being a function of temperature and magnetic field allows to remotely control the flow in them using the magnetic parameters. This paves way for exploration of promising and innovative ideas to achieve expected flow structures and heat transports by varying the strength and orientations of the magnetic field.

Keywords: Thermorheology, Magnetorheology, Ferrofluid, Sinusoidal, Non-sinusoidal, Modulation, Waveform