Comment on the Paper “Onset of Marangoni-Bénard Ferroconvection with Temperature Dependent Viscosity, C. E. Nanjundappa, I. S. Shivakumara, R. Arunkumar, Microgravity Sci. Technol. (2013) 25:103–112”

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Abstract The present comment concerns some doubtful results included in the above paper.

The effect of temperature dependent viscosity on the onset of Marangoni-Bénard ferroconvection under microgravity conditions in a horizontal ferrofluid layer in the presence of a uniform vertical magnetic field has been studied in the above paper. The viscosity is considered to be varying exponentially with temperature. The lower rigid and the upper horizontal free boundaries were considered to be perfectly insulated to temperature perturbations.

The non-dimensional velocity boundary condition at the lower plate is as follows (Eq. 27 in Nanjundappa et al. 2013)

$$W = DW = 0 \quad \text{at} \quad z = 0 \quad (1)$$

where W is the non-dimensional vertical velocity, D is the differential operator $D = d/dz$ and z is the non-dimensional vertical distance ($z = 0$ at the lower plate and $z = 1$ at the upper plate).

According to above boundary condition (1) velocity profiles should approach the lower rigid plate with zero gradient. However, the above boundary conditions is not satisfied in Fig. 6 presented by Nanjundappa et al. (2013). In Fig. 1 of

the present work we show a real dimensionless velocity profile from Nanjundappa et al. (2013) taken from their Fig. 6 and a second velocity profile proposed by the present author (sketch). The quantity R_m is the magnetic Rayleigh number and the quantity B is the viscosity parameter. It is seen that the velocity profile presented by Nanjundappa et al. (2013) meets the lower plate with a steep angle with non-zero gradient ($DW = dW/dz \neq 0$) violating the boundary conditions $DW = dW/dz = 0$. The proposed velocity profile is in agreement with the boundary condition (1) of the present work.

All profiles in Fig. 6 of Nanjundappa et al. (2013) do not comply with the boundary condition (1) and are wrong.

Fig. 1 The existing dimensionless velocity profile is given by Nanjundappa et al. (2013, Fig. 6) for $B = 5$. The proposed velocity profile is in agreement with the boundary condition (1) of the present work

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