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CORRIGENDUM

The effect of wall heating on instability of channel flow – CORRIGENDUM

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During an attempt to work on a stratified flow problem envisaged as a sequel of the paper by Sameen & Govindarajan (2007), it was found that the original paper contained errors in §§ 3.4 and 4.3 due to a factor of iα, which was inadvertently missed in two places in the code (i) in the buoyancy term due to the use of vertical velocity and streamfunction interchangeably, and (ii) in the apportionment between kinetic and potential energy in the G_{max} calculation. Because of this, there were significant differences in the effect of Grashof number on stability. Figure 1 is the modified figure 9 of the original paper, for $Pr=7$ and $\Delta T=25\,\text{K}$. The Poiseuille–Rayleigh–Bénard mode appears at $Gr=39.12$ and is seen not to merge with the Poiseuille mode, unlike the conclusion made earlier. This modification applies at any Prandtl number from 10^{-2} to 10^{2}. The corrected versions of figures 17 and 21, showing G_{max} contours for different Pr at $Gr=0$ and different Gr for $Pr=1$, are plotted in figures 2 and 3, respectively. The large growth reported at $\beta=0$ was thus erroneous. The other main conclusions of the paper, that Prandtl number changes transient growth qualitatively, but not the least stable eigenmode, whereas viscosity stratification, which has a huge impact on exponential growth/decay, does not change transient growth much, remain the same. The secondary instabilities also remain unchanged. The stability equations (3.2) to (3.4) in the paper should read (for explanation, please refer to Sameen & Govindarajan 2007)

$$
\begin{aligned}
&\mathrm{i}\alpha\left[(v''-(\alpha^2+\beta^2))(U-c)-U''v\right]=\frac{1}{Re}\Bigg[\mu\left[v^{\mathrm{iv}}-2(\alpha^2+\beta^2)v''+(\alpha^2+\beta^2)^2v\right]\\
&+\frac{\mathrm{d}\mu}{\mathrm{d}T}T'2[v'''-(\alpha^2+\beta^2)v']+\frac{\mathrm{d}\mu}{\mathrm{d}T}T''[v''+(\alpha^2+\beta^2)v]+\frac{\mathrm{d}^2\mu}{\mathrm{d}T^2}\left(T'\right)^2[v''+(\alpha^2+\beta^2)v]\\
&-\frac{\mathrm{d}\mu}{\mathrm{d}T}\mathrm{i}\alpha[U'\hat{T}''+2U''\hat{T}'+(\alpha^2U'+U''')\hat{T}]-2\mathrm{i}\alpha\frac{\mathrm{d}^2\mu}{\mathrm{d}T^2}U'T'\hat{T}'-\mathrm{i}\alpha\frac{\mathrm{d}^2\mu}{\mathrm{d}T^2}T''U'\hat{T}\\
&-2\mathrm{i}\alpha\frac{\mathrm{d}^2\mu}{\mathrm{d}T^2}U''T'\hat{T}-\mathrm{i}\alpha\frac{\mathrm{d}^3\mu}{\mathrm{d}T^3}U'(T')^2\hat{T}+\frac{Gr}{Re}(\alpha^2+\beta^2)\hat{T}\Bigg],
\end{aligned}
\tag{1}
$$

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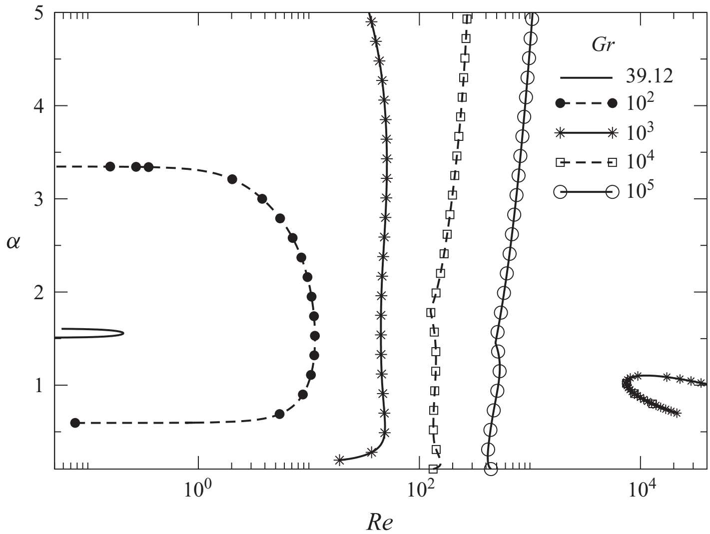

FIGURE 1. Neutral curves for unstably stratified flow at Prandtl number 7.0, $\Delta T = 25$ K. The Rayleigh–Bénard like mode first appears at $Gr = 39.12$. The Tollmien–Schlichting mode does not merge with this.

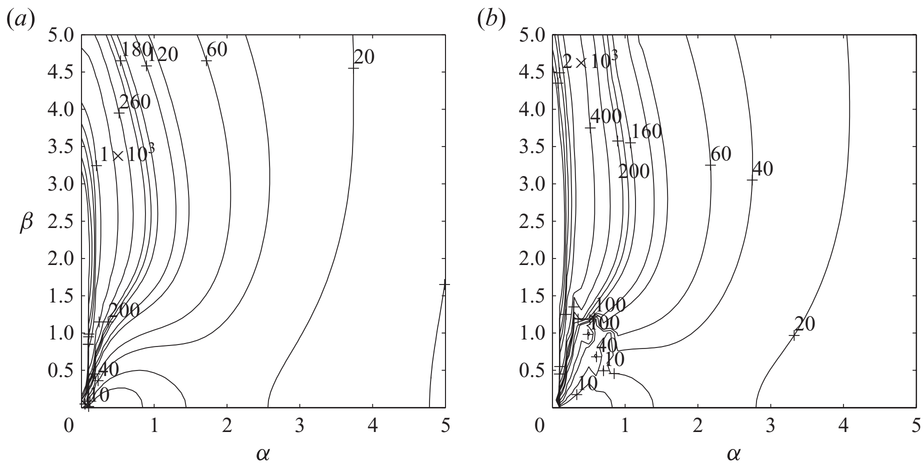

FIGURE 2. Contour plot of G_{max} for $\Delta T = 25$ K, $Re = 1000$ for $Pr = 1$ (a) and $Pr = 100$ (b). This is the corrected plot of figure 17 of the original paper.

$$\mathrm{i}\alpha(U-c)\eta + \mathrm{i}\beta U' v = \frac{1}{Re}\left[\mu\left[\eta'' - (\alpha^2+\beta^2)\eta\right] + \frac{\mathrm{d}\mu}{\mathrm{d}T}T'\eta' + \mathrm{i}\beta\frac{\mathrm{d}\mu}{\mathrm{d}T}(U''\hat{T} + U'\hat{T}') + \mathrm{i}\beta\frac{\mathrm{d}^2\mu}{\mathrm{d}T^2}T'U'\hat{T}\right], \quad (2)$$

$$\mathrm{i}\alpha(U-c)\hat{T} + T'v = \frac{1}{RePr}[\hat{T}'' - (\alpha^2+\beta^2)\hat{T}]. \quad (3)$$

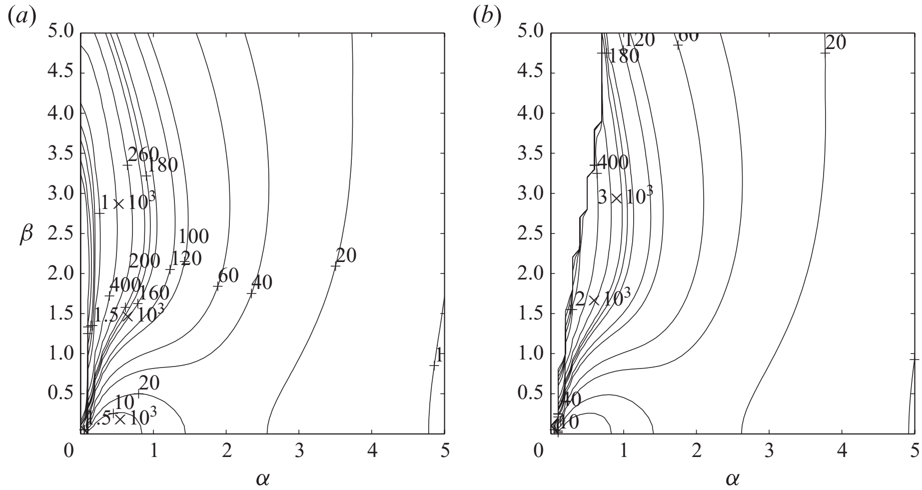

FIGURE 3. The corrected plot of figure 21 of the original paper for $Pr = 1$ and $Re = 1000$. The (*a*) and (*b*) contour plots are for $Gr = 100$ and $Gr = 10^4$, respectively.

REFERENCE

SAMEEN, A. & GOVINDARAJAN, R. 2007 The effect of wall heating on instability of channel flow. *J. Fluid Mech.* **577**, 417–442.