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CORRIGENDA

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Small inertial effects on a spherical bubble, drop or particle moving near a wall in a time-dependent linear flow

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Some numerical errors were recently discovered in §§6 and 7 of the above paper. It is the purpose of this corrigendum to provide the corrected expressions and clarify the discussion of the corresponding results.

After re-evaluating the leading-order integral involved in the derivation of equation (21), it turns out that the factor 27/16 should be changed to 2, so that the near-wall rotation-induced lift force experienced by a drop translating with the slip velocity $\boldsymbol{V}_{S0}$ in a rotating flow about the x_3-axis is

$$\boldsymbol{F}_{L} = \frac{\pi}{2} Ta \left[R_{\mu}^{2} \left(\kappa^{-1} \left(1 + \frac{3}{4} R_{\mu} \kappa \right) \right) + \frac{8}{3} \right] \boldsymbol{e}_3 \times \boldsymbol{V}_{S0} + O(\kappa). \tag{1}$$

This changes the result (24) for a drop centrifuged in the same flow to

$$\boldsymbol{F}''_{U} + \boldsymbol{F}''_{L} = -\pi Ta \left[R_{\mu}^{2} \left(\frac{5}{2} \kappa^{-1} - \frac{24 + 44\lambda - 126\lambda^2 - 191\lambda^3}{48(1+\lambda)(2+3\lambda)^2} + \frac{8}{21(2+3\lambda)^2} \bar{\rho} \right) - \frac{4}{3} \right] \boldsymbol{e}_3 \times \boldsymbol{V}_{S0} + O(\kappa). \tag{2}$$

In the discussion following (21), on p. 132, a factor -6π is missing in the expression for the counterpart of (1) in an unbounded flow. The correct expression of this force for a rigid sphere is thus $\boldsymbol{F}_L = -(9\pi/140)\sqrt{2}(19 - 9\sqrt{3}) Ta^{1/2} \boldsymbol{e}_3 \times \boldsymbol{V}_{S0}$ (Gotoh 1990) and the factor by which this expression has to be multiplied to be generalized to a drop of arbitrary viscosity is $\frac{4}{9} R_{\mu}^2$ instead of R_{μ}^2 as erroneously written (the latter remark also holds for the other situations discussed in §§6 and 7). Comparing Gotoh's expression with (1) reveals that wall effects reverse the sign of the lift force, unlike what happens in a pure shear flow (see §6). This means for instance that a particle at rest in a rotating container experiences a centripetal lift force when it stays far from the endwalls, whereas this force becomes centrifugal when the dimensionless separation κ^{-1} between the particle and one of the endwalls becomes small compared with $Ta^{-1/2}$.

Also, after correcting the value of one of the integrals involved in the derivation of equation (17), the factor $E_0(\lambda)$ (which also appears in equation (56*b*) of Magnaudet, Takagi & Legendre 2003) becomes

$$E_0(\lambda) = \frac{4840 + 11796\lambda + 6174\lambda^2 - 1265\lambda^3}{1200(2+3\lambda)^2(1+\lambda)}, \tag{3}$$

so that the shear-induced lift force in equation (17) may be written in the form

$$\boldsymbol{F}_{\mathrm{L}} = -\frac{\pi}{8} Re\,\alpha\, R_\mu^2 \left\{ 5\left(\kappa^{-1}\left(1+\frac{9}{8}R_\mu\kappa\right) + G_1(\lambda)\right)(\boldsymbol{V}_{\mathrm{S}0}\boldsymbol{\cdot}\boldsymbol{e}_3)\boldsymbol{e}_1 + \frac{11}{3}\left(\kappa^{-1}\left(1+\frac{9}{8}R_\mu\kappa\right) + G_2(\lambda)\right)(\boldsymbol{V}_{\mathrm{S}0}\boldsymbol{\cdot}\boldsymbol{e}_1)\boldsymbol{e}_3 \right\} + O(\kappa) \quad (4)$$

with

$$G_1(\lambda) = -\frac{4}{75}\frac{(160+564\lambda+666\lambda^2+265\lambda^3)}{(1+\lambda)(2+3\lambda)^2}, \qquad G_2(\lambda) = -\frac{2}{55}\frac{\lambda(168+372\lambda+210\lambda^2)}{(1+\lambda)(2+3\lambda)^2}. \quad (5a,b)$$

While terms proportional to $R_\mu^2\kappa^{-1}$ and R_μ^3 in (1) and (4) are provided by the outer region of the disturbance and thus directly result from wall effects, the factor 8/3 in (1) and terms proportional to $G_1(\lambda)$ and $G_2(\lambda)$ in (4) are provided by the inner region located at distances from the particle much smaller than the separation (see e.g. the discussion of equation (14*a*) on p. 128). It then follows that the latter contributions are not influenced by the presence of the wall, so that they would remain unchanged if we were considering the rotation- or shear-induced lift force in an unbounded flow. For instance, (4) and (5*b*) show that for a rigid sphere the contribution proportional to $G_2(\lambda)$ yields a force equal to $\frac{7}{8}\pi\alpha Re(\boldsymbol{V}_{\mathrm{S}0}\boldsymbol{\cdot}\boldsymbol{e}_1)\boldsymbol{e}_3$, in agreement with Saffman's result for a freely rotating sphere in an unbounded shear flow (Saffman 1965). As in this inner region the flow about the particle is correctly described by Stokes approximation, superposition holds. Thus if we rotate the axes by $-\pi/2$ in the term involving $G_1(\lambda)$, this contribution becomes the second-order force experienced by a drop translating parallel to $\boldsymbol{e}_1$ in the shear flow $-\alpha x_1\boldsymbol{e}_3$. Adding the latter term to the one involving $G_2(\lambda)$, which is the second-order force on a drop translating parallel to $\boldsymbol{e}_1$ in the shear flow $\alpha x_3\boldsymbol{e}_1$, yields the second-order lift force experienced by a drop translating parallel to $\boldsymbol{e}_1$ in the solid-body rotation flow $\alpha(x_3\boldsymbol{e}_1 - x_1\boldsymbol{e}_3)$. Using (5) we then find that the corresponding force is $-\frac{4}{3}\pi\alpha Re(\boldsymbol{V}_{\mathrm{S}0}\boldsymbol{\cdot}\boldsymbol{e}_1)\boldsymbol{e}_3$, a result which now agrees with (1) provided we set $Ta = \alpha Re$ and change the rotation axis $\boldsymbol{e}_3$ to $\boldsymbol{e}_2$. It is worth noting that, while (5) indicates that the strength of the second-order lift force depends on the viscosity ratio λ in a pure shear flow, (1) shows that it is independent of the viscosity and hence purely inertial in a solid-body rotation flow.

Obviously the last two rows of table 1 on p. 117 which summarizes all the results of the paper must be changed according to (1) and (3).

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Dynamics of scalar dissipation in isotropic turbulence: a numerical and modelling study

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Owing to an error that arose inadvertently from a post-processing code, the values of the ratio $\sigma(\chi)/\mu(\chi)$ shown in the seventh row of table 3 are incorrect. The corrected values are given below. The previous values were too large and would suggest a higher level of intermittency of the scalar dissipation rate (χ) than that indicated by other measures such as the skewness and flatness computed from the same datasets. On the other hand, this correction does not affect any of the statements or conclusions made in the original paper.

R_λ	38	38	90	90	90	141	141	243	243
Sc	$\frac{1}{4}$	1	$\frac{1}{8}$	$\frac{1}{4}$	1	$\frac{1}{8}$	1	$\frac{1}{8}$	1
$\sigma(\chi)/\mu(\chi)$	1.73	2.14	2.00	2.26	2.62	2.27	2.62	3.01	3.22

The corrected values are also available in a subsequent paper published by two of us (Fox & Yeung 2003, table IV therein). However, we hope this corrigendum will help further ensure that future readers interested in using the numerical simulation data will not be misled.

We thank Professors K. R. Sreenivasan and R. W. Bilger for their communications which drew our attention to the error.

REFERENCE

Fox, R. O. & Yeung, P. K. 2003 Improved Lagrangian mixing models for passive scalars in isotropic turbulence. *Phys. Fluids* **15**, 961–985.