Elliptic instability of a curved Batchelor vortex - corrigendum

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Due to a normalisation mistake, a systematic error has been made in the values of the coefficients R_{AB} and R_{BA} in the dispersion relation (4.7) of Blanco-Rodríguez & Le Dizès (2016). The correct values are twice those indicated in this paper for all the modes. This modifies the values given in table 2 and formulas (C2n-q), (C3n-q), (C4n-q). For instance, in table 2 the correct value of R_{AB} for the mode $(-2, 0, 1)$ at $W_0 = 0.4$ is $R_{AB} = 2.302 + 0.382\mathrm{i}$ instead of $R_{AB} = 1.151 + 0.191\mathrm{i}$.

This error affects the y-scale of the plots (c) and (d) of figure 5 which has to be multiplied by two, and those of figure 6, which has to be divided by 2. It also changes all the figures obtained in section 8. The correct figures are given below (using the same figure numbers as in Blanco-Rodríguez & Le Dizès (2016)).

The comparison with Widnall & Tsai (1977) done in section 8.1 for a vortex ring is also slightly modified. With the correct normalisation, the inviscid result of Widnall & Tsai (1977) for the Rankine vortex is $\sigma_{max}/\varepsilon^2 = [(0.428 \log(8/\varepsilon) - 0.455)^2 - 0.113]^{1/2}$ while we obtain for the Lamb-Oseen vortex $\sigma_{max}/\varepsilon^2 = 0.5171 \log(8/\varepsilon) - 0.9285$. The Lamb-Oseen vortex ring is thus less unstable than the Rankine vortex ring as soon as $\varepsilon > 0.039$ for the same reason as previously indicated.

REFERENCES

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Widnall, S. E. & Tsai, C.-Y. 1977 The instability of the thin vortex ring of constant vorticity. *Phil. Trans. R. Soc. London* A **287**, 273–305.

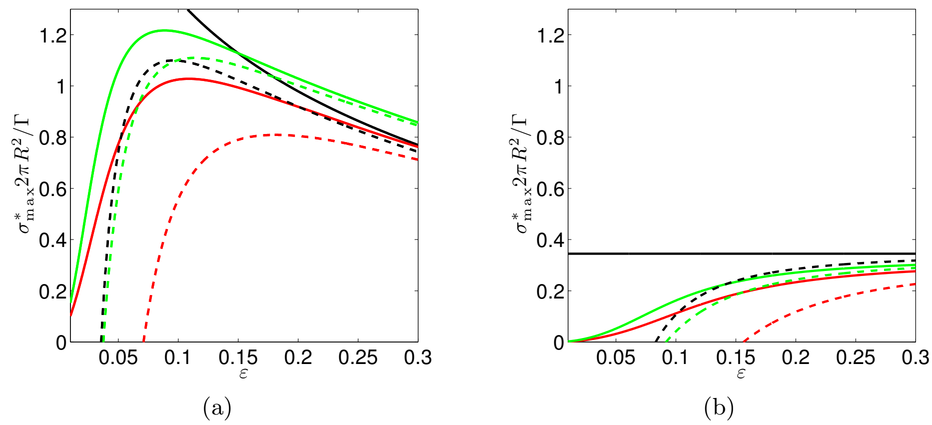

FIGURE 8. Maximum elliptic instability growth rate $\sigma_{\max}/\varepsilon^2 = \sigma^*_{\max} 2\pi R^2/\Gamma$ versus $\varepsilon = a/R$ for a vortex ring of radius R (a), and 2 counter-rotating vortices distant of $2R$ (b), both of core size a. Black lines: $W_0 = 0$ (mode $(-1, 1, 1)$), red lines: $W_0 = 0.2$ (mode $(-2, 0, 2)$), green lines: $W_0 = 0.4$ (mode $(-2, 0, 1)$). Solid lines are for $Re = \infty$, dashed lines for $Re = 5000$. For both cases, the perturbation wavenumber is assumed not to be discretized (see figure 9).

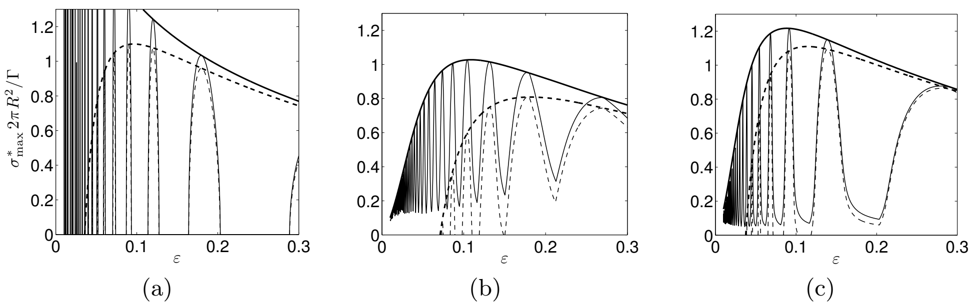

FIGURE 9. Elliptic instability growth rate $\sigma_{\max}/\varepsilon^2 = \sigma^*_{\max} 2\pi R^2/\Gamma$ for a vortex ring of radius $R = 1/\varepsilon$ for $Re = \infty$ (solid lines) and $Re = 5000$ (dashed lines). Thick lines are the maximum growth rate curves plotted in figure 8(a), thin lines are the growth rate curves assuming that the instability wavenumbers are discretized and only take the values $k_n = 2\pi n\varepsilon$, $n = 1, 2, 3, \cdots$. (a): $W_0 = 0$ (mode $(-1, 1, 1)$), (b): $W_0 = 0.2$ (mode $(-2, 0, 2)$), (c): $W_0 = 0.4$ (mode $(-2, 0, 1)$).

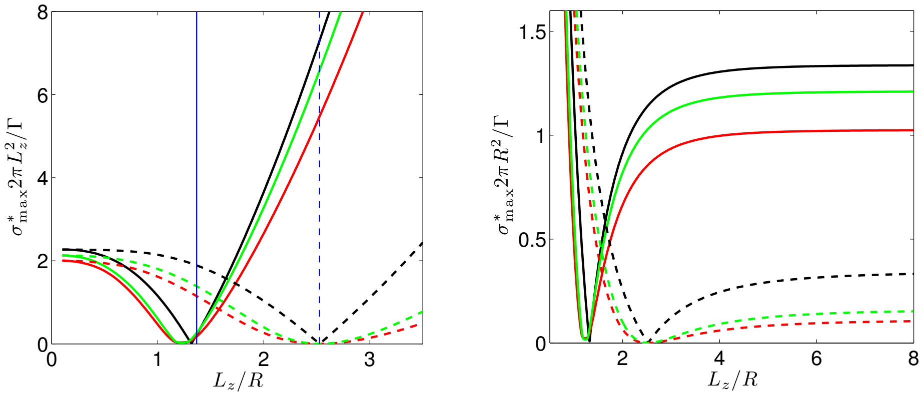

FIGURE 10. Maximum elliptic instability growth rate versus L_z/R of an array of alternate vortex rings (solid lines) and of an array of straight counter-rotating vortex pairs of alternate sign (dashed lines) for $\varepsilon = a/R = 0.1$ and $Re = \infty$. Black lines: $W_0 = 0$ (mode $(-1,1,1)$), red lines: $W_0 = 0.2$ (mode $(-2,0,2)$), green lines: $W_0 = 0.4$ (mode $(-2,0,1)$). Left plot: normalization with $\Gamma/(2\pi L_z^2)$. Right plot: normalization with $\Gamma/(2\pi R^2)$. The vertical lines on the left plot indicate the value of L_z/R where the local strain rate vanishes for each configuration.

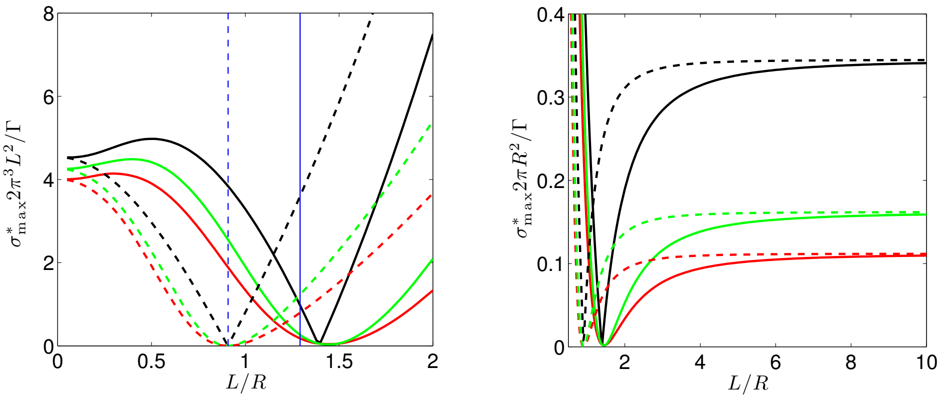

FIGURE 11. Maximum elliptic instability growth rate versus L/R of two helical vortices (solid lines) and of an double-array of straight co-rotating vortices (dashed lines) for $a/R = 0.1$ and $Re = \infty$. Black lines: $W_0 = 0$ (mode $(-1,1,1)$), red lines: $W_0 = 0.2$ (mode $(-2,0,2)$), green lines: $W_0 = 0.4$ (mode $(-2,0,1)$). Left plot: normalization with $\Gamma/(2\pi^3 L^2)$. Right plot: normalization with $\Gamma/(2\pi R^2)$. The vertical lines on the left plot indicate the value of L/R where the local strain rate vanishes for each configuration.