Erratum: Non-Riemannian geometry of vortex acoustics [Phys. Rev. D 70, 064004 (2004)]

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There are two misprints in formulas of this paper, which nevertheless induce errors in the interpretation of the fluid model used in the paper. The first misprint is an elementary one and does not change any results in the paper. It is simply an extra ∇ gradient operator in front of α in Eq. (17). The second one leads to more serious consequences but actually avoids the problems with flow inconsistency in the first publication of the paper. After correcting this misprint the original Eq. (19) reads

$$K^0 \partial_t \Psi_1 = \frac{\rho_0}{c^2} \Omega_0 \times \vec{v}_0 \cdot \vec{v}_1, \tag{19}$$

where $v_1 := \nabla \Psi_1$ which in fact turns the contortion relation on a differential equation. In comparison with the original incorrect expression for the Cartan contortion component K^0 we note that this expression is free from the inconsistencies in the fluid flow of the original equation. Besides when the contortion component K^0 vanishes one notes the expression $\vec{v}_1 = b\vec{v}_0$, where b is a proportionality constant. This expression in turns leads to $\Omega_1 = \nabla \times \vec{v}_1 = b\Omega_0$, but since the perturbed fluid is assumed to be irrotational Ω_1 vanishes. This last relation implies that the background vorticity Ω_0 also vanishes, which in turn shows the consistency of the model that says that a non-Riemannian geometrical structure called acoustic torsion is necessary, at least as far as this particular example is concerned, to consider analog gravitational models in fluids with vorticity. The corrected expression also sheds some light on the controversy of the contamination of the perturbation by the background vorticity. A further generalization of that paper is possible by including non-Riemannian fluids with viscosity where the Cartan contortion appears also in terms of viscosity of the fluid. Effective Riemannian and non-Riemannian geometries with vortex acoustic turbulent models are also presently under investigation.

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