Errata to:
Shock reflection in gas dynamics
(Handbook of Math. Fluid Dynamics, Vol. 4)

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The size of the subsonic zone

Section 6.3 is incorrect. For instance (121) implies that $|y - u_1| > c_1$ everywhere along the reflected shock. Thus Figure 18 is false, since the shock may not enter the sonic circle of state U_1.

Contrary to footnote 23 (25 in printed text), the correct treatment of the reflected shock is that of reference [63] ([65] in printed text):

> D. Serre. Ecoulements de fluides parfaits en deux variables indépendantes de type espace. Réflexion d'un choc plan par un dièdre compressif. *Arch. Rational Mech. Anal.*, **132**:15–36, 1995.

The generation of vorticity across a shock

The analysis of section 2.3 is incorrect and the result in Theorem 2.6 must be restated the following way:

> Let U be a two-dimensional steady flow of a barotropic fluid. Assume that U is constant on one side Ω^- of a $\mathcal{C}^1$ shock curve S, and is of class $\mathcal{C}^1$ on the other side Ω^+. Assume at last that ω vanishes over Ω^+. Then either S is a straight line, or the function
> $$\rho \mapsto \int_{\rho_-}^{\rho} \frac{p'(s)}{s} ds + \frac{1}{2}\left(\frac{1}{\rho} + \frac{1}{\rho_-}\right)(p(\rho_-) - p(\rho))$$
> is constant on some non-trivial interval.

Here is the correct argument: Let $\rho \mapsto H(\rho)$ denote the function defined above, and $h(\rho)$ the integral in it. From $\rho(u \cdot \nabla)u + \nabla p = 0$, we deduce $(u \cdot \nabla)u + \nabla h(\rho) = 0$. Since $\omega = 0$, this is equivalent to $\nabla(|u|^2/2 + h(\rho)) = 0$. In other words, $|u|^2/2 + h(\rho)$ is constant over Ω_+, and in particular along S_+. However $|u|^2 = (u \cdot \nu)^2 + (u \cdot \tau)^2$, where we have

$$u \cdot \tau = u_- \cdot \tau, \qquad u \cdot \nu = \frac{j}{\rho}, \quad j = \rho_- u_- \cdot \nu.$$

Thus we may write

$$j^2\left(\frac{1}{\rho^2}-\frac{1}{\rho_-^2}\right)+2h(\rho)=\text{cst}. \tag{1}$$

On another hand, the Rankine-Hugoniot condition gives

$$j^2\left[\frac{1}{\rho}\right]+[p(\rho)]=0.$$

We may eliminate $j^2[1/\rho]$ with (1) and obtain that $H(\rho)$ is constant along S_+. If H is not constant on a non-trivial interval, this implies that ρ is constant, and therefore $u_- \cdot \nu$ is constant. But this means that ν is constant, and thus S is a straight line.

Remark that for a Chaplygin gas, H is a constant, and there exist shocks between a constant state and a non-constant irrotational flow, where the shock curve is not straight. Such examples of course contradict theorem 2.6.