Errata (State: 2015)

■ 1. Description of Diffusion

■ Section 1.1.2.1. Fick's Laws (page 16)

Last sentence reads correctly (temperature difference ΔT instead of temperature T):

Equation (1.3) also occurs in connection with Fourier's theory of heat conduction, where in this case the mass density ρ is replaced by the temperature difference ΔT.

■ Section 1.1.4.4. Solution to the Difference Equation (page 20)

The formula reads correctly ($v\,t - x$ instead of $x - v\,t$):

$$\rho[x,\,t] = \frac{1}{2\,v\,\Delta t}\,\frac{1}{2^{\frac{t}{\Delta t}}}\begin{pmatrix}\frac{t}{\Delta t}\\ \frac{x+v\,t}{2\,v\,\Delta t}\end{pmatrix} = \left(\frac{1}{2\,v\,\Delta t}\,\frac{1}{2^{\frac{t}{\Delta t}}}\,\frac{\left(\frac{t}{\Delta t}\right)!}{\left(\frac{x+v\,t}{2\,v\,\Delta t}\right)!\left(\frac{v\,t-x}{2\,v\,\Delta t}\right)!}\right). \tag{1.10}$$

■ Section 1.1.5.2. Hypothesis on Variance (page 22)

The hypothesis in the **3rd** paragraph is erroneous. Correct is the following, always negative variance:

$$\sigma^2 = \frac{1}{2}\,v^2\,\Delta t\left(2\,t + \Delta t - e^{\frac{2\,t}{\Delta t}}\,\Delta t\right) = 2\,t\,\lambda + \Delta t\,\lambda - e^{\frac{2\,t}{\Delta t}}\,\Delta t\,\lambda = -\frac{2\,\lambda\,t^2}{\Delta t} - \frac{4\,\lambda\,t^3}{3\,\Delta t^2} - \frac{2\,\lambda\,t^4}{3\,\Delta t^3} + O[t]^5\,.$$

A negative variance points to diffusion into the imaginary part and questions the choosen model (1.12).

The comparison to the variance of Cattaneo's equation

$$\sigma^2 = 2\,\lambda\,(t-\tau) + 2\,\lambda\,\tau\,\mathrm{Exp}[-t/\tau] \tag{1.8}$$

yields a formal identity for $\Delta t \to -2\,\tau$, but $\lambda = \frac{v^2\,\Delta t}{2} = v^2\,\tau > 0$ being positive in both cases—see equation (1.7).

■ Section 1.2.2.3. Classification Scheme of Diffusive Processes

The systematics, being introduced as part of this elaboration, concerns on diffusive processes in free space. At boundary layers to other media, also mathematically for all linear equations there is partial or total reflection, which changes the variance behaviour totally and leads to the homogeneous distribution of the solution with temporal constant variance.

Especially in case of *thermal reflection*, being little payed attention to, for example in spaceships the phenomenon occurs, that the spaceships do not cool down in the temperature of space, declared to be **3** ***K***, if just the radiation balance is ruled.

■ Section 1.3.3. Space Fractional Diffusion Equations

Meanwhile the proof to the variance theorem for finite limits has been successful (see errata to appendix A). By this opens up the possibility to compare also all Lévy distributions to measured data in the sense of Einstein's relation. For finite limits, the power law in variance is expected to be replaced by a more complicated function, the asymptotics of which of course again can be a power law in the corresponding measurement section. Because of missing results, this aspect has been examined only little in the current elaboration.

■ 2.