

Since—as follows from the theorem of addition of velocities (§ 5)—the vector  $(u_\xi, u_\eta, u_\zeta)$  is nothing else than the velocity of the electric charge, measured in the system  $k$ , we have the proof that, on the basis of our kinematical principles, the electrodynamic foundation of Lorentz’s theory of the electrodynamics of moving bodies is in agreement with the principle of relativity.

In addition I may briefly remark that the following important law may easily be deduced from the developed equations: If an electrically charged body is in motion anywhere in space without altering its charge when regarded from a system of co-ordinates moving with the body, its charge also remains—when regarded from the “stationary” system  $K$ —constant.

### § 10. Dynamics of the Slowly Accelerated Electron

Let there be in motion in an electromagnetic field an electrically charged particle (in the sequel called an “electron”), for the law of motion of which we assume as follows:—

If the electron is at rest at a given epoch, the motion of the electron ensues in the next instant of time according to the equations

$$\begin{aligned} m \frac{d^2 x}{dt^2} &= \epsilon X \\ m \frac{d^2 y}{dt^2} &= \epsilon Y \\ m \frac{d^2 z}{dt^2} &= \epsilon Z \end{aligned}$$

where  $x, y, z$  denote the co-ordinates of the electron, and  $m$  the mass of the electron, as long as its motion is slow.

Now, secondly, let the velocity of the electron at a given epoch be  $v$ . We seek the law of motion of the electron in the immediately ensuing instants of time.

Without affecting the general character of our considerations, we may and will assume that the electron, at the moment when we give it our attention, is at the origin of the co-ordinates, and moves with the velocity  $v$  along the axis of  $X$  of the system  $K$ . It is then clear that at the given moment ( $t = 0$ ) the electron is at rest relatively to a system of co-ordinates which is in parallel motion with velocity  $v$  along the axis of  $X$ .

From the above assumption, in combination with the principle of relativity, it is clear that in the immediately ensuing time (for small values of  $t$ ) the electron, viewed from the system  $k$ , moves in accordance with the equations

$$\begin{aligned} m \frac{d^2 \xi}{d\tau^2} &= \epsilon X', \\ m \frac{d^2 \eta}{d\tau^2} &= \epsilon Y', \end{aligned}$$