Avoiding Infinities from the Lorentz and the Poincaré Transformations

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From the historical point-of-view, this paper gave history of conceptual development of relativity as well as mathematical formulation of Lorentz transformations. Contrary to the popular belief, giving credit of all contributions in special relativity to Albert Einstein, the paper put into perspective the fundamental conceptual contributions of Muslim scientists, e.g., A. Einstein, and absolute, long before, Einstein presented his theory. One year before the publication of Einstein’s paper, Poincaré (1904) elucidated the principle of relativity. Also, complete mathematical framework was available through works of W. Voigt (1887), J. Larmor (1897) and H. A. Lorentz (1892). Long before that Ibn-Sina discussed space and time, relativistic, in his Risala-t-Tahyvait (Journal of Physics). In his book, Agha-e-Antijaam (Beginning and End), Nasruddin Tusi (1238 Iranian Year) says that time exists everywhere and, therefore, something is first and something is last to relative time. Time ordering, of events (causality) occupies an important place in modern relativity theory. Tusi, further, observed that the entire universe is ascribed by space and in this connection, something is exposed and something is hidden relative to space. In addition, he comments that space and time are not complete in themselves. In theory of relativity space and time are not considered as separate things, but time is considered as a coordinate like space coordinates. In his paper, Zur Elektrodynamik bewegter Korper (on the Electro-dynamics of Moving Bodies), published in 1905, Albert Einstein combined these existing conceptual and mathematical formulae into an integrated and an unified approach, without giving reference to these contributions. Herman Minkowski formulated the relativity theory in terms of a four-dimensional-vector-field formulation. As early as 1911, it was shown that the assumption of existence of an invariant velocity for the derivation of Lorentz transformations and the set the relevant postulates in the form: (i) space-time is homogeneous and space is isotropic, (ii) principle of relativity — physical laws of mechanics and electromagnetism are required to be covariant, when passing from an inertial frame to another, and (iii) principle of equivalence — which are, clearly, finite. However, no attempt was made to compensate for the transformation matrix, whose nonzero elements \( \alpha_2 \beta_1 \) and \( \gamma_2 \) (with respect to the frame) represented by the superscript \( SC \). The scaling may be considered as

\[
\alpha_1 = \gamma_1 = \gamma_2 = \alpha_2 = \beta_1 = 1, \quad \beta_2 = \gamma = \frac{1}{c} \sqrt{1 - \beta^2}, \quad (\gamma \text{ is relative velocity of the frames and } c \text{ is velocity of light in free space). The condition } X = Y = Z = 0 \text{ should give history of the space origin of the frame, represented by the superscript } \alpha, \text{ with respect to the frame, represented by the superscript } \delta. \text{ A corollary of this condition is that } c^2 \text{ represents velocity of the frames with respect to the frame } \delta. \text{ Poincaré transformations are undefined if frame velocity is taken to be zero.}\]

For each sub-index of a tensor field, multiply the scaled coordinate by a factor of \( \gamma \). Using the inversion of equation of continuity \( \gamma = \frac{d \rho}{d t} \), the electrodynamic equations \( F_{\mu \nu} = \frac{d B_{\mu \nu}}{d t} \text{ and the electromagnetic fields are done using momentum approach instead of acceleration approach. This work circumvents the notorious difficulties of infinite without invoking any radical change in the physical-mathematical of relativity and, hence, the rest of the formulation. The formulation may be useful to astronomers, astrophysicists, field theorists, particle physicists as well as condensed-matter physicists, as the formulation has the potential to simplify formulations in quantum kinetic theories. Similar solutions need to be found out for in-finites appearing in curvature-tensor fields useful in gravitation physics.}

Keywords
Relativity, quantum field theory, infinities, singularities

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Fig. 1. Coordinate transformations

Scale-Poincaré Transformations
Poincaré Transformations
Lorentz Transformations
Restricted-Lorentz Transformations
Galilean Transformations

Limiting case v \( \rightarrow c \)