On a New Analysis of the Foundations of Classical Mechanics. I. Dynamics

TEMUR Z. KALANOV, Home of Physical Problems, Pisatelskaya 6a, 100200 Tashkent, Uzbekistan — The approach to the critical analysis of classical mechanics, based on formal logic, is proposed. From the logic point of view, the problem is that to identify a material point $M$, i.e. to establish the identity relation between concepts “physical object $M$” and “mathematical object $M$”. The idea of the correct solution of this problem is as follows. As it is known, the material point $M$ is characterized by following quantities: mass $m_M$; position in system of coordinates at the moment of time $t$; velocity $\vec{v}_M(t)$; acceleration $d\vec{v}_M/dt$. If mass and velocity are essential (dynamic) properties (signs) of a material point $M$, then momentum $\vec{p}_M(t) \equiv m_M \vec{v}_M(t)$ represents the dynamic identifier of a material point $M$. In this case, expressions for kinetic energy $E^{(\text{kin})}_M(t) \equiv \frac{\vec{p}_M^2}{m_M} = m_M \vec{v}_M^2(t)$ and for force $\vec{f}_M \equiv d\vec{p}_M/dt$ are consequences of this identifier. It means that $\vec{f}_M \equiv d\vec{p}_M/dt$ is a definition of force, and mass $m_M$ should be determined by other identifier. Force is a vector manifestation of energy. Thus, the logic approach to the analysis of classical mechanics leads to correct definition of force.

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