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Functional Equations and Invariance in Scientific Laws

Two fundamental invariance principles are formulated which enable the derivation of some common physical laws via functional equation techniques. The first invariance principle, called 'meaningfulness', is germane to the common practice requiring that the form of a scientific law must not be altered by a change of the units of the measurement scales. The second principle requires that the output variable of the law be 'order-invariant' with respect to any monotonic transformation (of one of the input variables) belonging to a particular class of such transformations which is characteristic of the law. These two principles are formulated as axioms of the scientific theory. Three applications are mentioned, which involve: the Lorentz–Fitzerald Contraction, Beer's Law, and the Monomial Laws. The first one is described in some details. If all scientific laws should arguably be meaningful, not all of them are order-invariant in the sense of this work. An example is van der Waals' Equation. Open problems are proposed.