Natural Unit Representation in Modelica

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A method is presented by which alternative systems of physical units may be represented and utilized in Modelica. The method may be useful in simulating models of physical systems where the base units of the International System of Units (Système international d'unités, SI)—the standard unit system in Modelica—are poorly scaled. It also provides a convenient means to express the values of physical quantities in fields of science and engineering where data is typically represented in other systems of units or where the rank of the system of units is less than that of SI (i.e., natural units). By explicitly expressing the value of a physical quantity as the product of a number and a unit (where the unit is an algebraic variable), the method uses variables that are unit-neutral. Unfortunately, workarounds are necessary in order to implement the method in the current version of the Modelica language. Nonetheless, it may be useful in special applications, and the related discussion may provide valuable insight. In particular, it is shown that there is an apparent conflict in the interpretation of "number" and "value" between Modelica and the International Bureau of Weights and Measures (Bureau International des Poids et Mesures, BIPM).