3 The Universal System of Units Standard

As described in the introduction, the Universal Unit System is defined as a unit system that is constructed using the dozenal number system and 'the speed of light in a vacuum', 'the quantum of action', and 'the Boltzmann constant' as the defining constants such that these constants are strict multiples of integer powers of 12 of the unit quantities and 'the Rydberg constant', 'the atomic mass unit', 'the Bohr radius', and 'half the value of the Planck length' are approximated by multiples of integer powers of 12 of the unit quantities. All unit systems that satisfy this definition are 'Universal Unit System'.

However, although this concept corresponds to our world wide 'metric system', it still contains degrees of freedom. The metric system, too, includes various types of systems, such as the MKS unit system or CGS unit system, the absolute system of units or the gravitational system of units, rationalized systems of units or non-rationalized systems of units.

Therefore, in this section, I would like to attempt a proposal for a standard that equivalent to the worldwide International System of Units (SI—Système International d'Unités), as standard which I will refer to as the Universal System of Units Standard in the following, to distinguish it from simply a Universal Unit System.

One of the most important points concerning the formulation of the specifications is the selection of the dimensions for the base units.

The concept of quantity is defined axiomatically by formulas that express natural laws, so the dimensions of the base unit, too, are selected on the basis of the ease of deriving units while considering their mutual relations, somewhat as in solving simultaneous equations.[5,6,7] Accordingly, it is difficult to explain the process of selecting the dimension for each base unit in a systematic way. Therefore, taking the International System of Units (SI) as an example, I would like to explain it in the form of explaining the discrepancies with the Universal System of Units Standard.

The dimensions of the base units of the International System of Units (SI) are length, time, mass, thermodynamic temperature, electrical current, amount of substance, and luminous intensity; the units of plane angle and solid angle were classified as supplementary units that are vague in character.

As opposed to that, the Universal System of Units Standard employ **impedance, plane angle, logarithmic quantity, amount of substance, length, time, energy, and thermodynamic temperature** as the base unit dimensions. The first four of these have natural units that are employed as base units just as they are. We create quantities of the remaining four dimensions that serve as base units by multiplication or division of the Rydberg constant,[6] the speed of light in a vacuum, the quantum of action, and the Boltzmann constant, which are fundamental physical constants used in deriving units.

1. Replacement of mass with energy

   The reason for selecting energy instead of mass is that it is more suitable as a starting point for the derivation of units such as force, work, pressure, and electrical charge. Selecting energy makes it easier to understand the meaning of quantities when the dimensions of various quantities are represented by the multiplication or division of the dimensions of the base units. The unit for pressure, for example, is $\mathrm{kg}/(\mathrm{m}\cdot\mathrm{s}^2)$ in the International System of Units (SI). It is probably not intuitively understandable why there is one m in the denominator. In contrast to this, in the Universal System of Units Standard, when the unit of pressure is expressed by the multiplication

[6] The reason for selecting the Rydberg constant as a defining constant is made clear in the section 3.3 "Defining constants and base units".