Abstract
The present author has remarked before that a message for interstellar communication, written in
some unknown symbolism, supposedly meaningful, but exempt from direct clues for its
interpretation, presents formidable challenges to receiving parties. If a natural language is behind
the message, what are the syntactic and semantic characteristics of it? How to decide whether the
meaning of a message relies on some language? The case that there is no (natural) language behind
a given message because the underlying expressive technique is mathematical, is even more
complex because of compact notation. A message of that kind, annotated by formal terms in an
abstract system (i.e. a Lingua Cosmica), is only comprehensible if the receiver realises or finds out
what the basis is of the utilised abstract lingua. Furthermore non-mathematical clues should be
included to explain that certain basic mathematical constructs are applicable in the message itself.

In the present paper the problem of constructing messages for ETI concerned with
mathematical modelling of physical phenomena is considered. Mathematical concepts relevant for
this kind of descriptions can be assumed universal. However, the formalisms used in the discourses,
notations for the spaces used, operations over them, reduction mechanisms etc., as we use them
today, have evolved in the course of centuries; they are the result of a long period of developments
in the science of formally describing physics. They contain in fact very many ad hoc agreements,
notational conventions developed for economy of notation and of course special symbols with
specific interpretations. This means that it is not feasible to construct interstellar messages
concerned with (astro)physical phenomena using ordinary mathematical notation.

The Lingua Cosmica (LINCOS) for interstellar communication advocated by the present
author in a number of papers, is based on constructive logic. So the primary purpose of using such a
lingua is to achieve guaranteed correct logical reasoning. LINCOS in pure form is, however, not
immediately applicable for describing mathematical modelling of physical reality because it has
only limited computational power. The present paper discusses two powerful modifications to the
underlying logic, introducing some aspects of computational nature. The following extensions are
considered: the introduction of non-deterministic typing and the use of symbolic computing. The
first consists of overloading type definitions and the second is realised by typing mathematical
symbolic expressions in logic terms. By means of examples the use of these devices is explicated.
Note that the formulation of essentially mathematical reasoning in LINCOS is not supposed to
replace the mathematics. These can be kept, even in situ. Supplementary logic terms are again
meant for annotation. An example of using the new elements is provided in the paper: the basics of
Einstein’s Special Relativity Theory (SRT) treated in the form of logic terms.

An advantage of using constructive logic even in the case that one is concerned with the
mathematical content of possibly large-size messages for ETI, is that basically the same logic is
used for all annotation - independent of the kind of message content. On the other hand if the
receiving party knows the particular type of mathematics we use for some application, the
annotation system can serve for the clarification of LINCOS conventions. This is a completely
different kind of clarification method than those that have been considered before: using music and
self-interpretation.

Alexander Ollongren. 23 December 2003