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LARGE-SIZE MESSAGE CONSTRUCTION FOR ETI

Non-deterministic typing and symbolic computation in *LINCOS*

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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