Review report on the paper "Seven-dimensional real and complex unsolvable Lie algebras"

The problem of classification of finite dimensional Lie algebras reduce to the following three separate tasks:

- Classification of nilpotent Lie algebras;
- Description of solvable algebras with given nilradical;
- Description Lie algebras with a given radical.

The latter two problems are the most studied part of the classification problem of Lie algebras and brought to fruition for the complex Lie algebras in the middle of the last century. The third problem is reduced to a description of semisimple subalgebras of the derivation algebras of a solvable algebra by A.I.Malcev. The problem of how to construct, by a given solvable algebra $\mathcal{R}$ and a semisimple algebra S, all the algebras L with the radical $\mathcal{R}$ and the quotient algebra $L/\mathcal{R}$ isomorphic to S, also has been solved. It turned out that such algebras L are finite in number, and they correspond one-to-one to semisimple subalgebras of the algebra of derivations of $\mathcal{R}$. Since semisimple algebras are completely described by the well-known theory of Cartan-Killing this problem reduces to the study of solvable algebras. The second problem is reduced to the description of the orbits of some nilpotent linear groups by another result of A.I.Malcev. Thus the classification problem of Lie algebras is reduced to the study of nilpotent algebras. This problem is the most complicated and, unfortunately, still there is no any standard way to solve it. There are a few results on complete classification of complex Lie algebras up to dimension six only.

The paper under the review is devoted to the classification problem of seven-dimensional abstract non-solvable Lie algebras. The author proposes an algorithm to reduce the problem of classification over a field of characteristic zero to the description of the so-called almost algebraic Lie algebras. This class its turn is divided into exact and non-exact subclasses and each is successfully classified. The algorithm is applied to classify seven-dimensional Lie algebras over $\mathbb{R}$ and $\mathbb{C}$. This result along with a few classification results obtained earlier by some other authors completes the solution to the classification problem of seven-dimensional Lie algebras over $\mathbb{R}$ and $\mathbb{C}$.

The content of the paper is well-organized. All statements are equipped by proofs. The paper can be recommended to be published in Siberian Electronic Mathematical Reports. Nevertheless, I would suggest to make the following amendments:

(1) Recently a few results on applications of Morozov-Mubarakzyanov method to Lie algebras and some other classes of algebras have been obtained. I would recommend to include them in the references.

(2) Since the paper is written in Russian I do not think it is logic to translate the titles of papers originally published in Russian (if it has a translation to other languages that can be included after the original in parentheses)

(3) Some of references in French and others in German. The language such papers must be given after the paper in parentheses.