

Assessment of the master thesis by Viktor Korotynskiy

Using Monodromy to Simplify Polynomial Systems

doc. Ing. Tomas Pajdla, Ph.D.
master thesis supervisor

The goals of the thesis were to review simplification of polynomial systems, Galois theory and relevant parts of algebraic topology related to monodromy of polynomial systems; to explain the connection between the monodromy group of a polynomial system with a finite number of solutions, its Galois group, and symmetries of this polynomial system, and to find an example of a relevant polynomial system that can be simplified by using its monodromy group. This is an advanced topic that is on the edge of current mathematical and engineering research.

The thesis presents three main contributions. First, the thesis collected and concisely presented a large number of theoretical elements from group theory, algebraic geometry, topology, and Galois theory. It presented how to combine these branches in order to understand the concept of symmetries. This is a major contribution because it provides a large volume of advanced mathematical material that was not accessible to engineers in so concise and crisp way before.

Secondly, the thesis explains the structure of the very important 5-point problem using the general theory. It illustrates how to analyze problems in general and explains the classical way of system simplification by the general theory. It also suggests a possible approach to a systematic discovery of symmetries. This is truly a new result that has not been known before. It explains a classical result and connects new theoretical tools to a very practical situation.

Finally, the thesis presents an analysis of having the possibility to simplify two minimal problems. It shows that one can't be simplified but the other can. These are, again, truly new results demonstrating the power of the general approach presented.

All three contributions of the thesis are going very much beyond a standard MSc thesis by the result, by the methods used, as well as by the quality of the presentation.

Viktor Korotynskiy was a very motivated, capable, and hard-working student. Viktor was able to grasp many deep concepts from various branches of mathematics and he has shown how to apply them to solve new problems that are connected to important practical applications. He presented very professional research work on the Ph.D. level and fulfilled all the goals set in the assignment.

This work is really exceptional and must be valued as *excellent (A)*.

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doc. Ing. Tomas Pajdla, Ph.D.
Thesis supervisor