A Functional Computer Algebra with Some Examples in Kotlin

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ABSTRACT

We present a type-safe numerical tower starting with a generically typed algebra of groups, rings and fields, and show how to extend it to various domains, with examples in the Kotlin programming language. This hierarchy allows us to perform generic transformations on mathematical symbol trees. Some applications include linear algebra, automatic differentation and probabilistic programming.

CCS CONCEPTS

• **Mathematics of computing → Mathematical software**.

KEYWORDS

computer algebra, symbolic mathematics

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1 INTRODUCTION

The expression problem [6] occurs when we want to implement some generic operator on multiple objects. They share the same interface, but have different implementations. Can we avoid writing it twice? Various solutions have been proposed [3, 4, 7].

Consider the following simplified example: ...

Can we avoid reimplementing it in multiple contexts?

2 CONTEXT-ORIENTED PROGRAMMING

TODO: Alex

3 FUNCTIONAL PROGRAMMING

TODO: Iaroslav?

4 SYMBOLIC DIFFERENTIATION

TODO: Breandan

5 COMPUTATIONAL GEOMETRY

TODO: Alex

6 PROBABILISTIC PROGRAMMING

TODO: Breandan

7 SIMPLIFICATION

TODO: Breandan

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A APPENDIX

A.1 Part One

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

A.2 Part Two

Etiam commodo feugiat nisl pulvinar pellentesque.

B ONLINE RESOURCES

https://github.com/mipt-npm/kmath
https://github.com/breandan/kotlingrad

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