CAS 741: Problem Statement
rkf45.ml

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Table 1: Revision History

Date	Developer(s)	Change
Sept 18	Alex	Addressed Dr. Smith's feedback; toned down metaprogramming, removed RKF45, emphasized ODE solver family library
Sept 15	Alex	Initial version

Scientists in many areas use ordinary differential equations (ODEs) in their research. For this reason, the goal of this project is to create a family of ODE solvers in the form of a reusable library.

While many solvers exist already, the emphasis on reuse hopefully spares scientists the effort of reimplementing these functions over and over, along with the associated increased chance of software bugs. Additionally, a new programming paradigm may both save time while creating the program family as well as provide performance benefits over existing approaches.[1]

Multi-stage programming (MSP) is a metaprogramming paradigm. Its goal is to enable development of "generic software that does not pay a runtime penalty for this generality"[2]. MSP allows programmers to generate entire product families once all possible variabilities have been accounted for. It also has the potential for performance benefits, which ultimately allow users of programs constructed in this way to focus more on their other activities.

One might argue that manually optimizing for performance is a thing of the past. While computer hardware has become much faster, a large portion of the world population that cannot afford the latest and greatest hardware and/or has a need for (less powerful) mobile hardware.

Primary stakeholders would be scientists using this implementation either directly or indirectly, as well as programmers integrating this implementation into larger pieces of software.

The environment of the software is limited to what the OCaml compiler supports, but this includes Windows, macOS and Linux.

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[1] https://arxiv.org/pdf/1612.06668
[2] https://web.archive.org/web/20170804032218/http://www.cs.rice.edu/~taha/publications/journal/dspg04a.pdf

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