

PLEASE TYPE**THE UNIVERSITY OF NEW SOUTH WALES
Thesis/Dissertation Sheet**Surname or Family name: **Roldugin**First name: **Georgy**

Other name/s:

Abbreviation for degree as given in the University calendar: **Master of Engineering**School: **Computer Science and Engineering**Faculty: **Engineering**Title: **Runtime Array Fusion for Data Parallelism****Abstract 350 words maximum: (PLEASE TYPE)**

The benefits of high level approach to parallel programming are well understood and are often desired in order to separate the domain view of the problem from the intricate implementation details. Yet, a naive execution of the resulting programs attracts unnecessary and even prohibitive performance costs.

One convenient way of expressing a program is by composing collective operations on large data structures. Even if these collective operations are implemented efficiently and provide a high degree of parallelism, the result of each operation must be fully computed and written into memory before the next operation can consume it as input. The cost of transferring these intermediate results to and from memory has a very noticeable impact on the performance of the algorithm and becomes a serious drawback of this high level approach.

Program optimisation which attempts to detect and eliminate the creation of intermediate results by combining multiple operations into one is known as fusion. While it is a well studied problem, there are unfilled gaps when it comes to fusing data parallel programs. In particular, I demonstrate solutions to the problems of fusion with multiple consumers as well as producing multiple results from one fused computation (tupling).

Through my research, I have designed and implemented an embedded domain specific language called LiveFusion that offers fusible combinators operating on flat and segmented arrays. To achieve fusion I propose a generic loop representation and use the concept of rates to guide fusion.

The results show that LiveFusion is considerably more effective at exploiting opportunities for fusion than previous systems. Specifically, the average performance increase of 3.2 for a non-trivial program indicates the attractiveness of the approach.

Declaration relating to disposition of project thesis/dissertation

I hereby grant to the University of New South Wales or its agents the right to archive and to make available my thesis or dissertation in whole or in part in the University libraries in all forms of media, now or here after known, subject to the provisions of the Copyright Act 1968. I retain all property rights, such as patent rights. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

I also authorise University Microfilms to use the 350 word abstract of my thesis in Dissertation Abstracts International (this is applicable to doctoral theses only).

Signature



Witness

Date **31.03.15**

The University recognises that there may be exceptional circumstances requiring restrictions on copying or conditions on use. Requests for restriction for a period of up to 2 years must be made in writing. Requests for a longer period of restriction may be considered in exceptional circumstances and require the approval of the Dean of Graduate Research.

FOR OFFICE USE ONLY

Date of completion of requirements for Award:

THIS SHEET IS TO BE GLUED TO THE INSIDE FRONT COVER OF THE THESIS