

Design and Implementation of an Invasive Multigrid Algorithm in X10 Programming Language

Outline

1 INTRODUCTION

- 1.1 Motivation: Describe why the chosen research area is important. Significance of parallel computing. Describe Invasive Computing - a new programming and resource management paradigm for parallel computing. Multigrid algorithm in scope of Invasive Computing. X10 – a new research parallel programming language, its advantages (particularly, for Invasive Computing)
- 1.2 Problem description. Describe the problem: Implementations of efficient Multigrid algorithm in X10 programming language for computation of differential equations. Importance and complexity of the problem. Why applying of X10 and Invasive Computing paradigm could allow solving the problem efficiently.

2 OVERVIEW OF APPROACHES TO PARALLEL PROGRAMMING

- 2.1 Basic terms and definitions
- 2.2 Overview and comparison of parallel programming paradigms: Review the most used parallel programming paradigms and concepts. Describe Invasive Computing paradigm. Compare different paradigms; indicate for which appliances Invasive Computing suits better
- 2.3 Parallel Programming Technologies
 - 2.3.1 PGAS programming languages
 - 2.3.2 X10 programming language

3 METHODS OF SOLVING DIFFERENTIAL EQUATIONS

- 3.1 Traditional approaches: one-level, fixed multi-level computations. Performance testing and resource usage analysis from literature. Advantages and drawbacks of the methods
- 3.2 Multigrid approach: class of adaptive multilevel algorithms. Multigrid application for solving differential equations. Possible algorithm modifications. Performance testing and resource usage analysis. Advantages and disadvantages.

4 DEVELOPMENT OF MULTIGRID ALGORITHM IN X10 USING INVASIVE COMPUTING PARADIGM

- 4.1 Project organization, methods and techniques used: concrete steps performed, methods for software design, development and performance testing. Used software
- 4.2 Straightforward implementation: List of used X10 constructs with brief explanations. Performance testing and analysis of performance problems – explain peculiarities of X10 constructions, which cause these problems
- 4.3 Performance tuning: propose X10 constructs, which should produce an effect on the performance, and explain why. Make a performance testing the improved version. Analyze the results and mark out the most significant improvements
- 4.4 X10 programming recommendations: propose a collection of ready-to-use recommendations (or patterns) for programming in X10, which can be applied for performing of typical operations in parallel programs in the most efficient way

5 SUMMARY

6 REFERENCES