Alan Turing's morphogenesis: on the wonders of nature

Vasilis Nicolaou

February 26, 2013

Contents

Abstract

Chapter 1

Introduction

1.1 Project Proposal

1.2 Background

1.3 Approach

1.4 Results

1.5 Report Structure

Chapter 2

Background

2.1 Mathematical Background

2.1.1 Linear Systems

2.2 Chemical background

2.3 Programming background

2.4 Tools Used

Chapter 3

Morphogenesis

3.1 Alan Turing

3.2 Gray Scott Model

3.3 Other models

Chapter 4

Mathematical Background

4.1 Dynamical Systems

4.1.1 Linear systems

4.1.2 Non-Linear Systems

4.2 Euler's Method

Chapter 5

Chemical Background

5.1 Chemical Reactions

5.2 Catalysts-Inhibitors

5.3 Morphogens

5.4 Examples

Chapter 6

Programming

6.1 Matlab

6.1.1 Modelling morphogenesis

6.1.2 Integrating differential equations

Numerical Stability

Plotting

6.1.3 Creating Movies

6.1.4 Playing Sound

6.2 Java

6.2.1 Implementing Euler's method

6.2.2 Thread management

6.2.3 Scheduling problem

Random scheduling

Round Robin

Random scheduling

Diffusion inspired scheduler

Chapter 7

Results

7.1 Chemical Reactions

7.2 Diffusion

7.3 Reaction-Diffusion

7.3.1 Linear Models

7.3.2 Non-Linear Models

7.4 Sound Producing

7.5 Scheduling Algorithms

7.5.1 Comparison

7.6 Summary of Results

Chapter 8

Conclusion

Appendix A

Matlab

A.1 Gray_Scott_Model.m

Appendix A

Java

A.1 ODE.java

Appendix A

References