A Distributed Computational Steering Environment for E-Learning Applications

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Agenda

- Introduction .
- Motivations.
- Objectives.
- STEEL (Steering Environment for Electronic Learning).
- Applications.
- Conclusions and future work.

Introduction

- Computational Steering :

  => the tight coupling of visualization and simulation.

  => Online and on the fly visualization .

  => Remote control of long running simulation.

  => Interactive simulation technique.

Introduction

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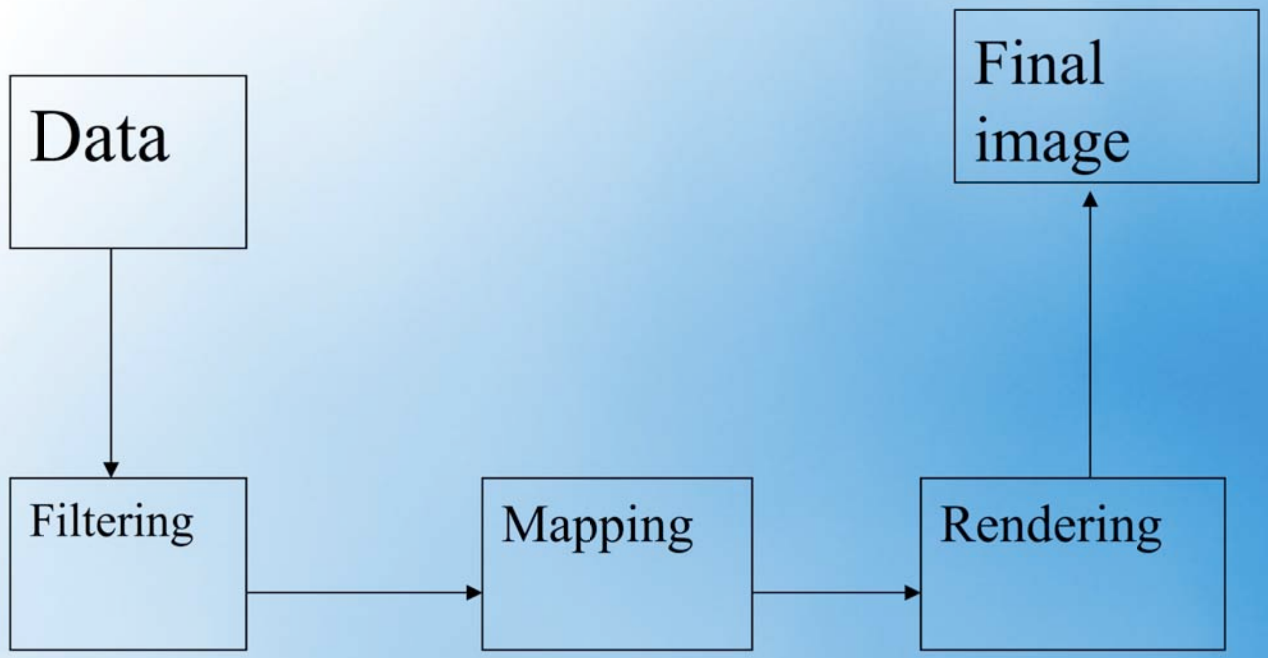
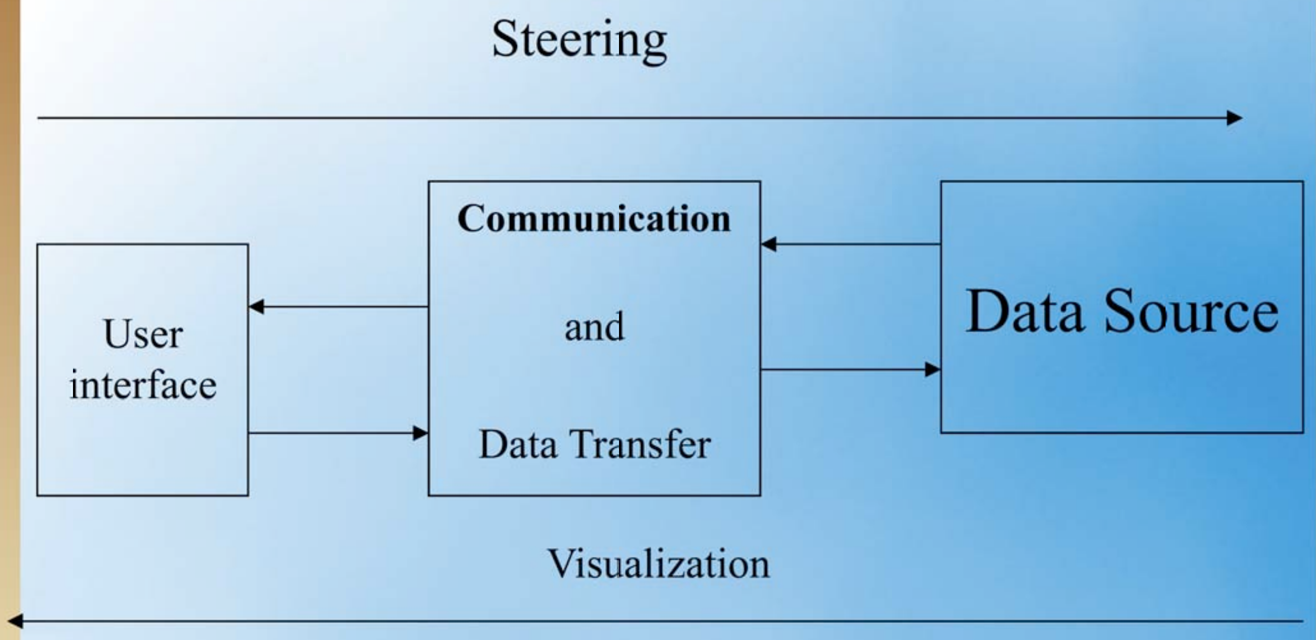


Haber and McNabb Visualization Reference Model

Introduction



Computational steering model

Introduction

Computational Steering Tasks

- *Model exploration.*
- *Algorithm experimentation.*
- Performance optimization.

Introduction

Model exploration

The user is primary interested in the application's input and output data. The main intention is to explore parameter spaces and simulation behavior to gain additional insight in the simulation

Introduction

Algorithm experimentation

Informs the user about the application's program structure

Introduction

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Performance optimization

Is used to provide information about the application's configuration and progress

Introduction

Computational Steering Approaches

- Program instrumentation.
- Direct Scientific Computation.
- Recasting Scientific Computation.

Introduction

Computational Steering Environments

- CSE
- DISCOVER
- POSSE
- RealityGrid
- SCIRun
- Progress and Magellan
- VASE
- Pablo

Motivations

- The ongoing efforts in modernizing learning .

- The need to change the learning from the traditional "schoolhouse" model into the networked virtual classroom.

Motivations (Cont.)

- The need of using interactive techniques in electronic learning.

Objectives

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Conclusions

- Designing collaborative and distributed computational steering environment for electronic learning.
- Developing a frame work for integration of existing application in the developed environment.
- Applying the developed environment in learning abstract scientific concepts.

STEEL

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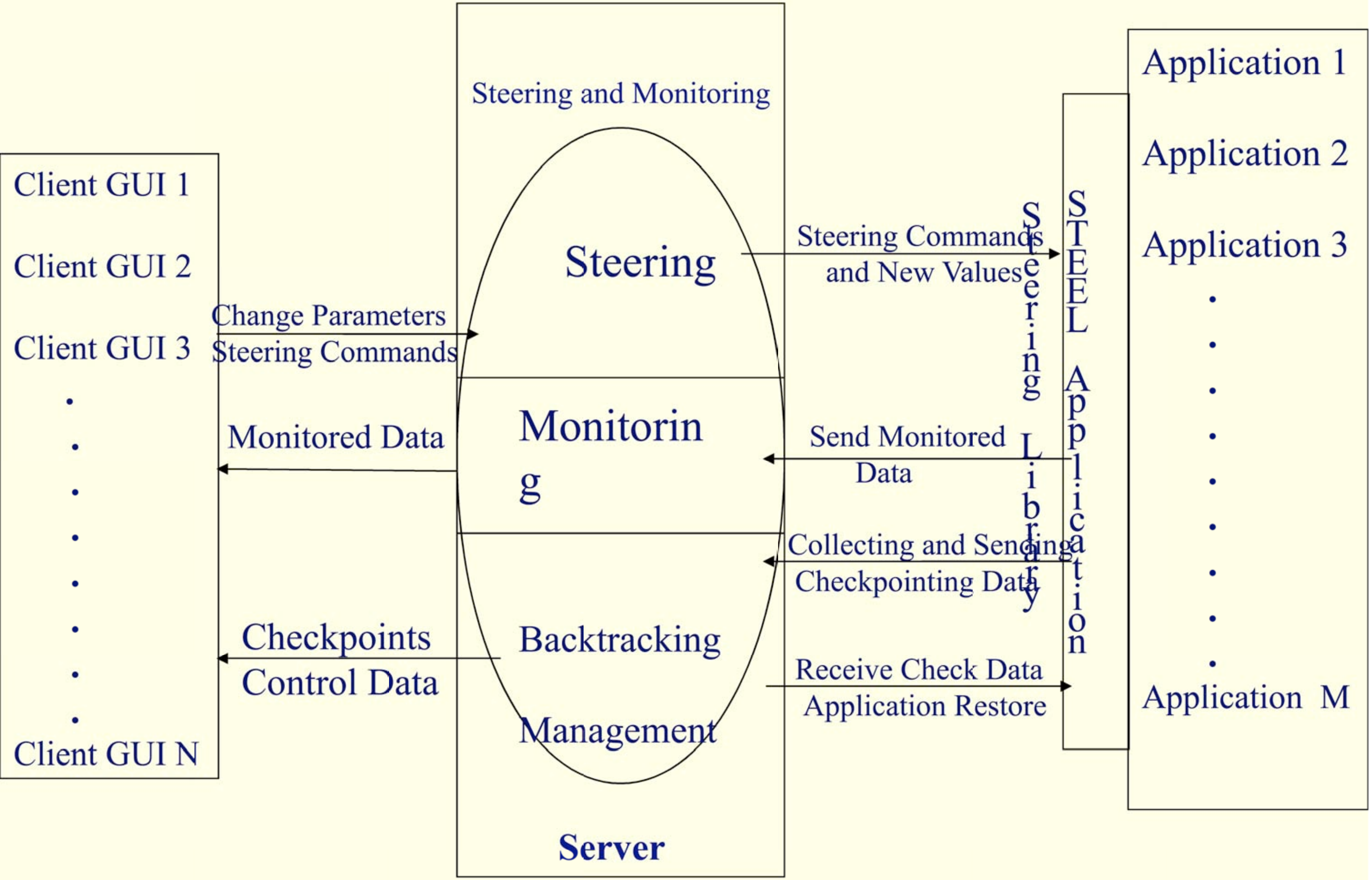
STeering Environment for Electronic Learning.

STEEL Architecture



STEEL Architecture

- GUI Editor.
- Steering and Monitoring Server.
- Runtime Utility.
- Steering API Library.

STEEL Architecture (Cont.)

- Introduction
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- Objectives
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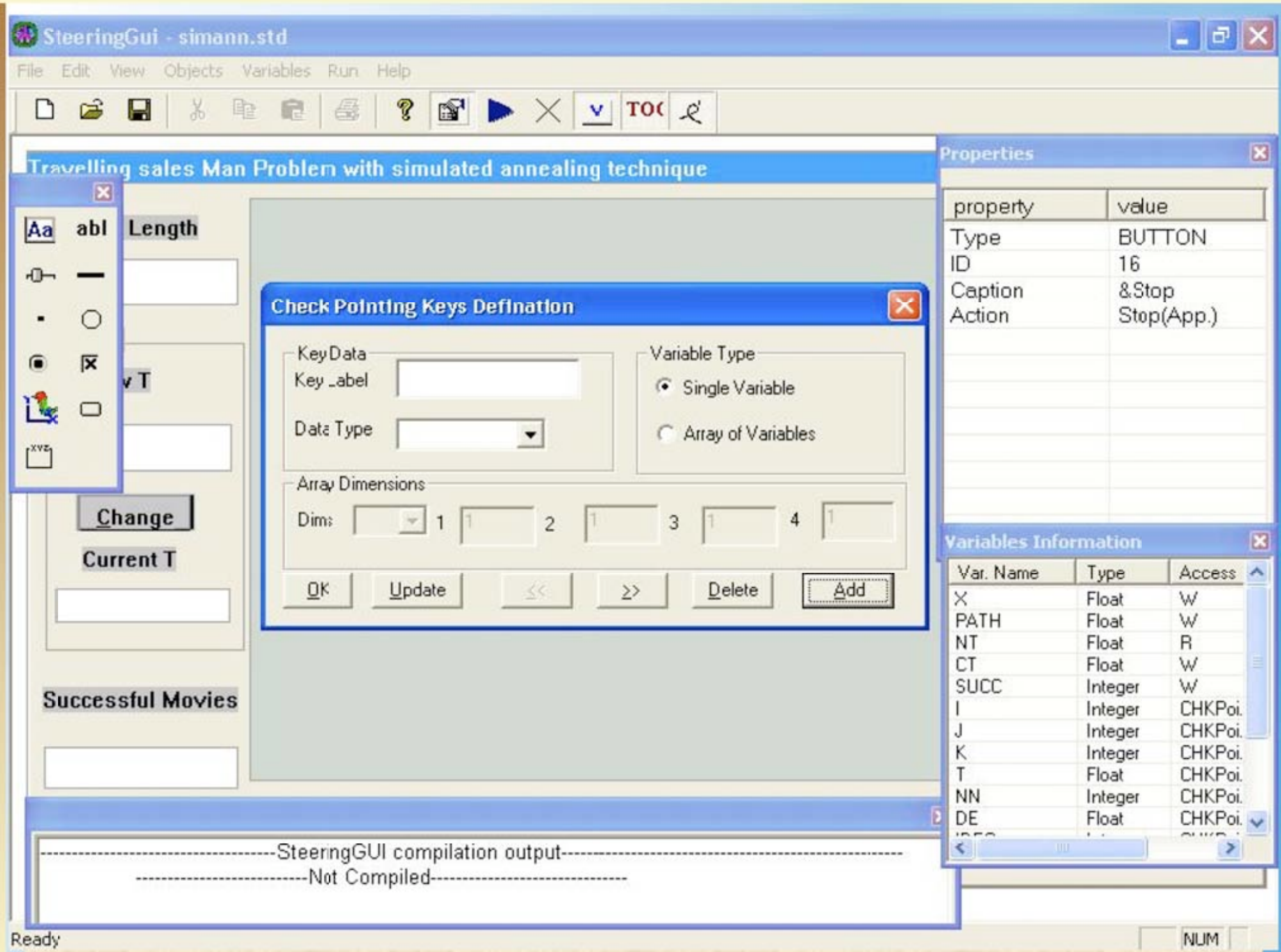
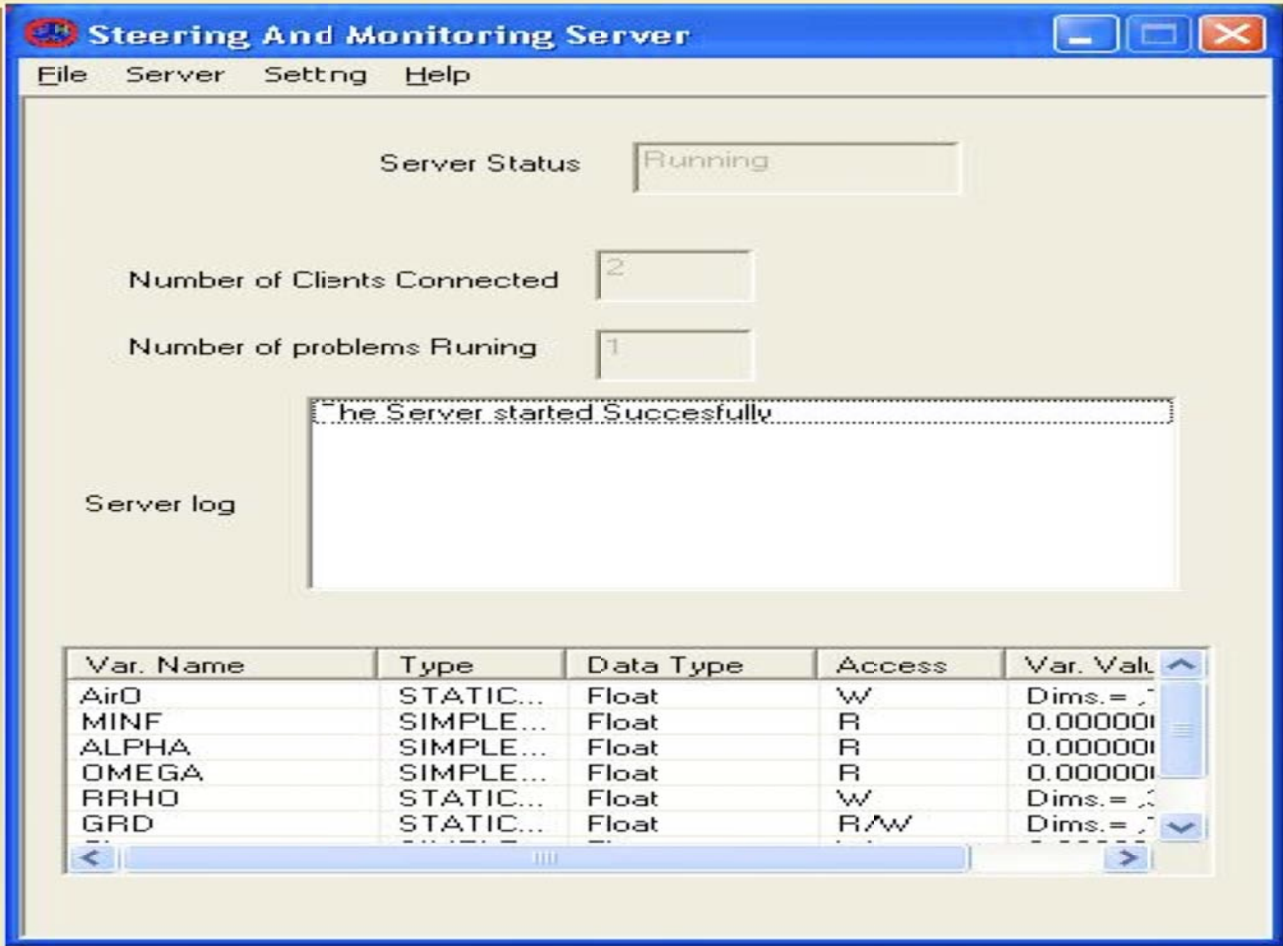
- Conclusions



STEEL GUI Editor

STEEL Architecture (Cont.)



STEEL Steering and Monitoring Server

STEEL Architecture (Cont.)

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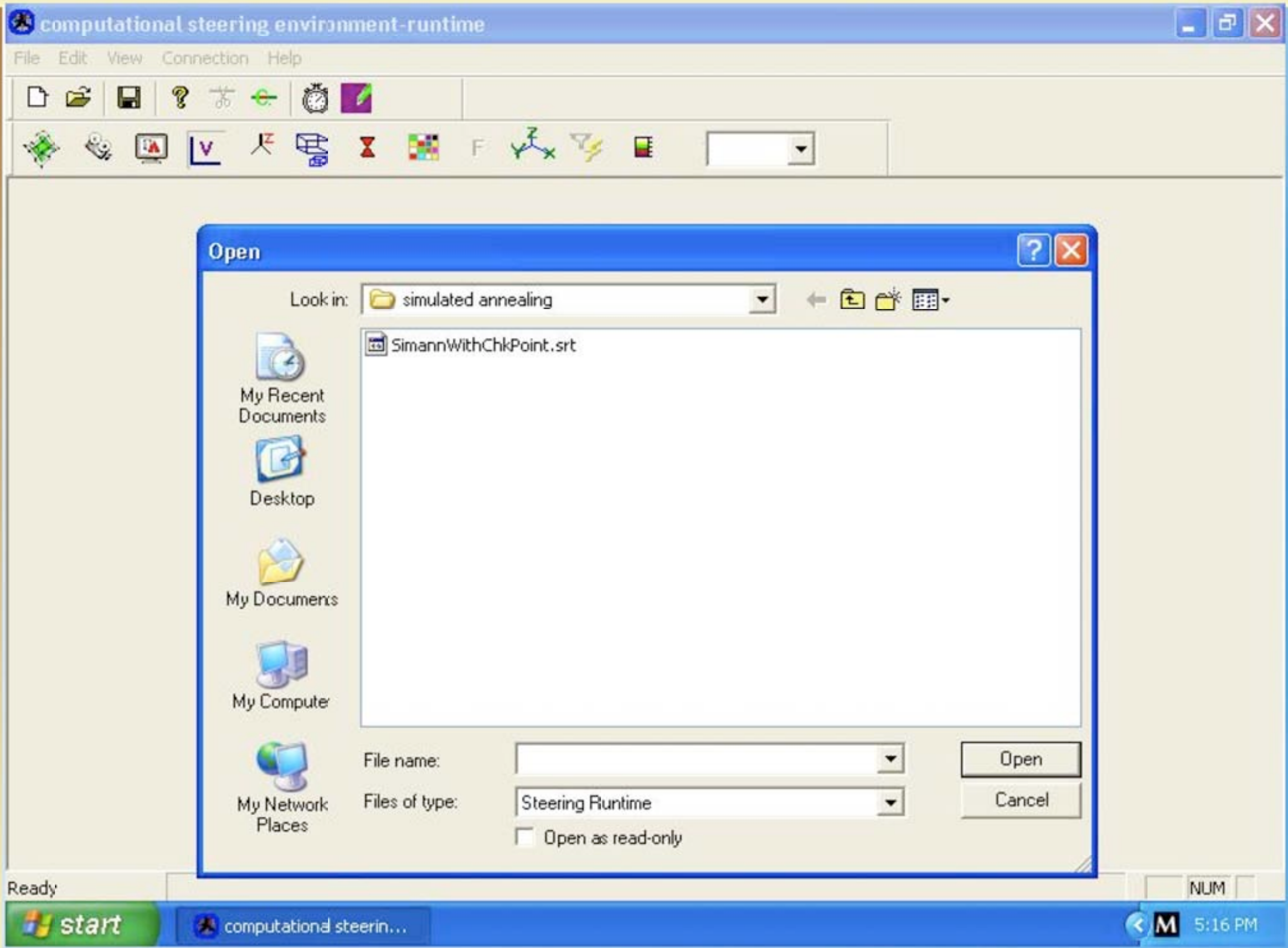


STEEL Runtime Utility

STEEL Architecture (Cont.)

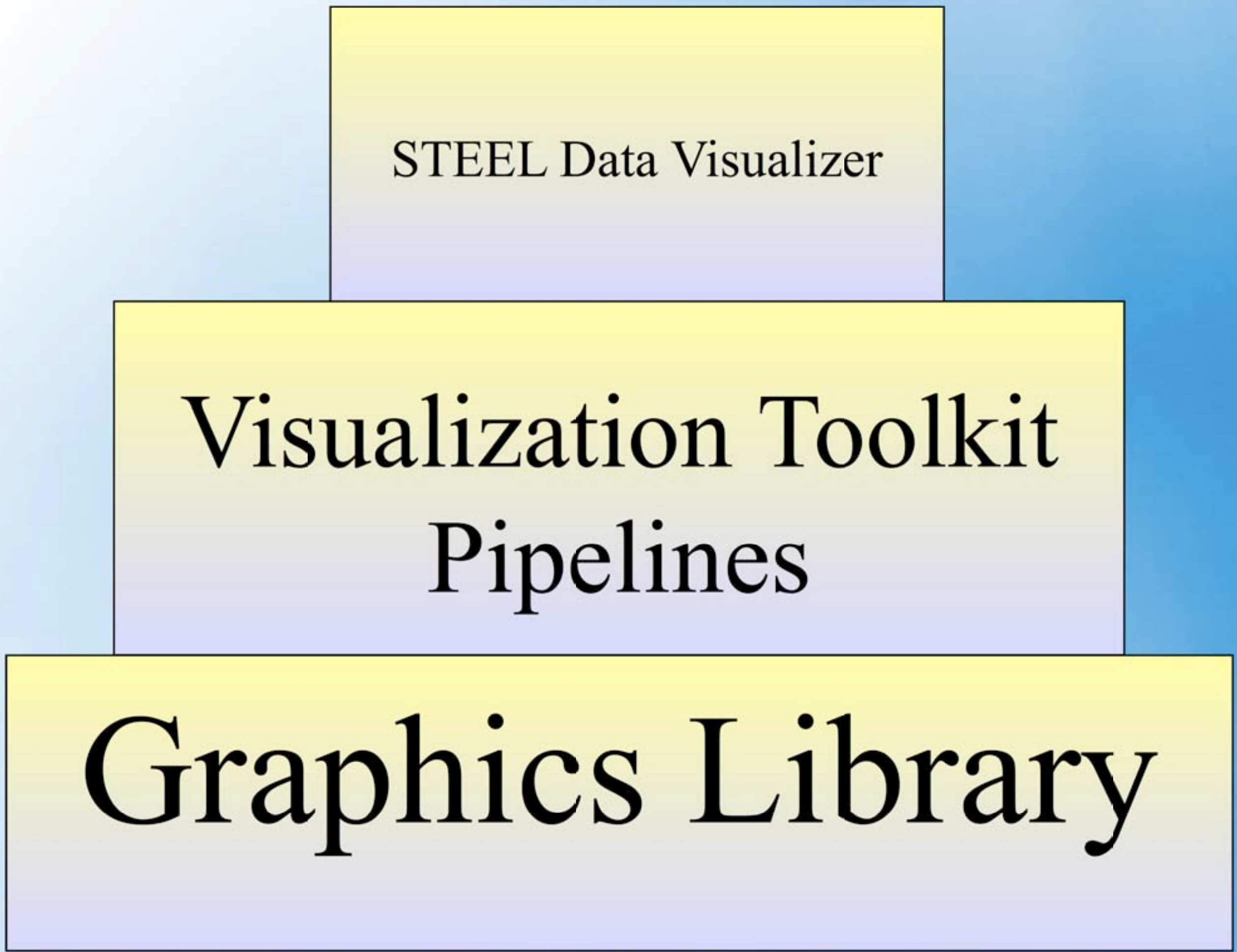
- A library of API Calls.
- Injected into the original application code.
- Responsible for communicating the input and output of the application data.
- Can be called from Fortran, C, or C++ .

STEEL Steering API

STEEL Users

- Developer: develops the application using the GUI design and STEEL API.
- End users (students) : use the developed application using the GUI runtime utility.

Visualization Using STEEL



Advantages of The Developed Framework

- Can be used to implement distributed and collaborative learning environments.
- Can integrate existing codes easily.
- Can be used in complex simulation through its support for parallelism.
- Allow the rollback to previous stages

Applications

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Conclusions

- The Interactive solution of the traveling salesman problem.
- Numerical flow simulation and visualization past an airfoil at transonic speeds.
- Image Analogies.

The traveling salesman problem using simulated annealing Algorithm

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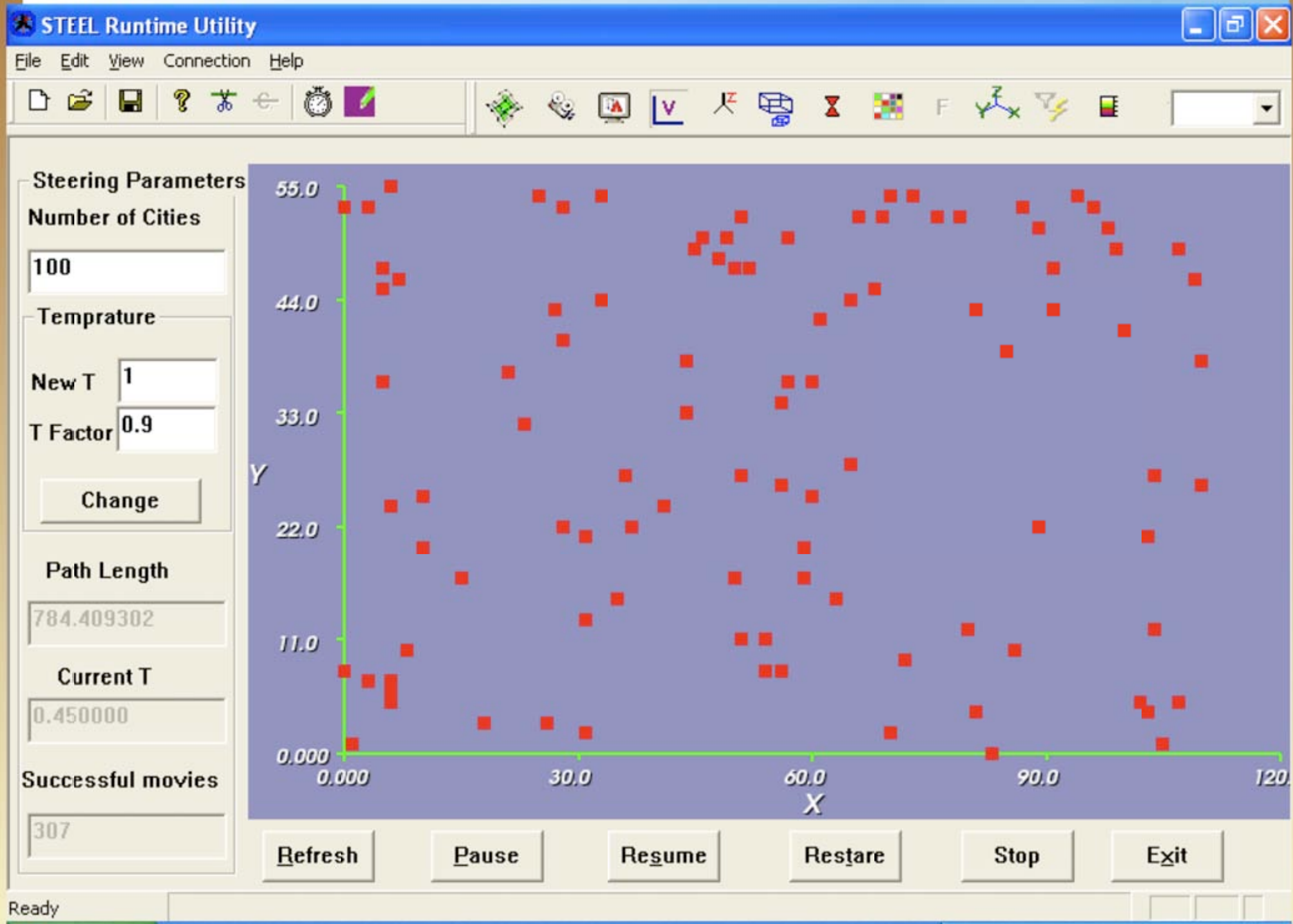
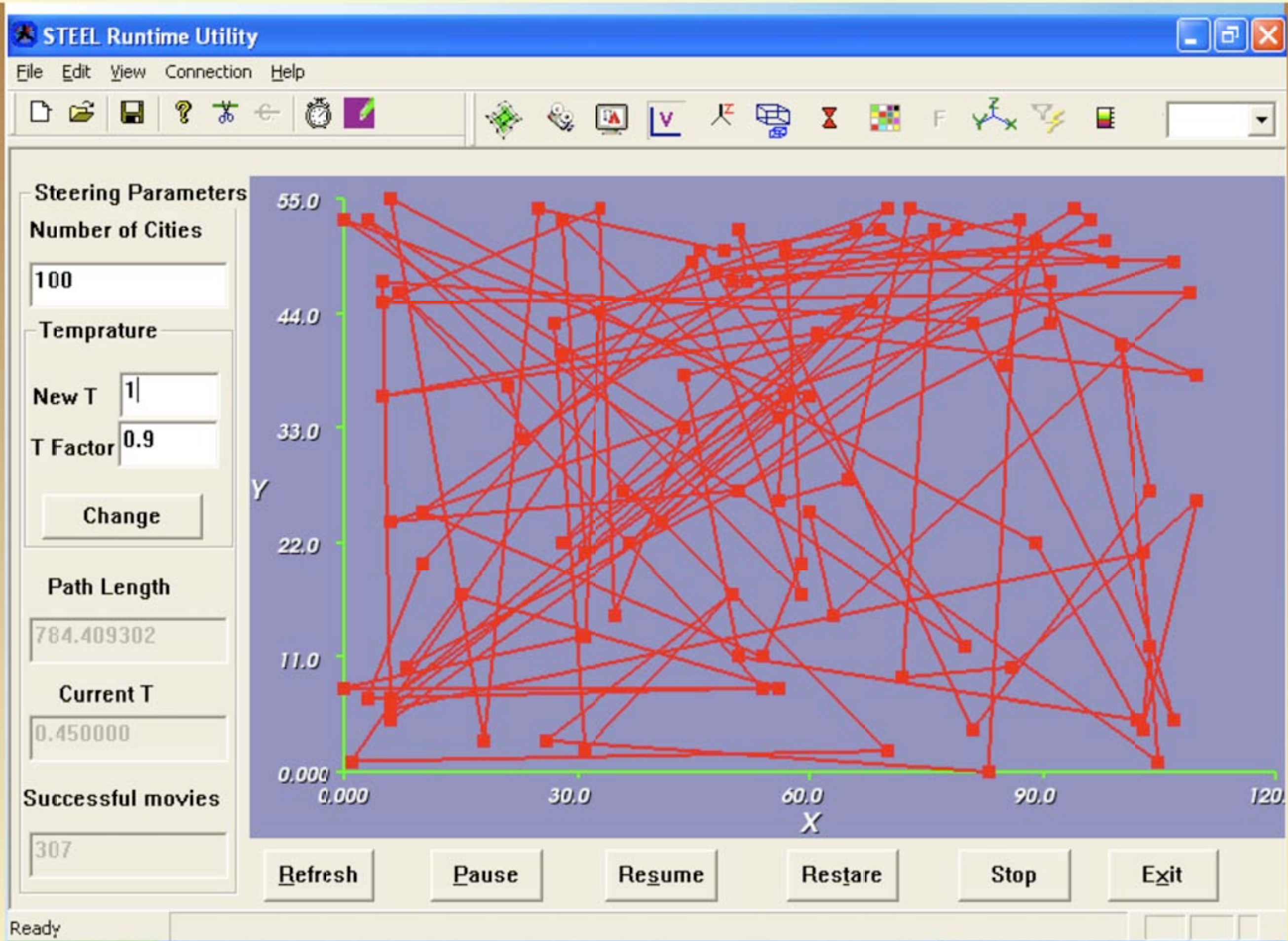


Random Number of Points Representing 100 Cites

The traveling salesman problem using simulated annealing Algorithm



Initial Path

The traveling salesman problem using simulated annealing Algorithm

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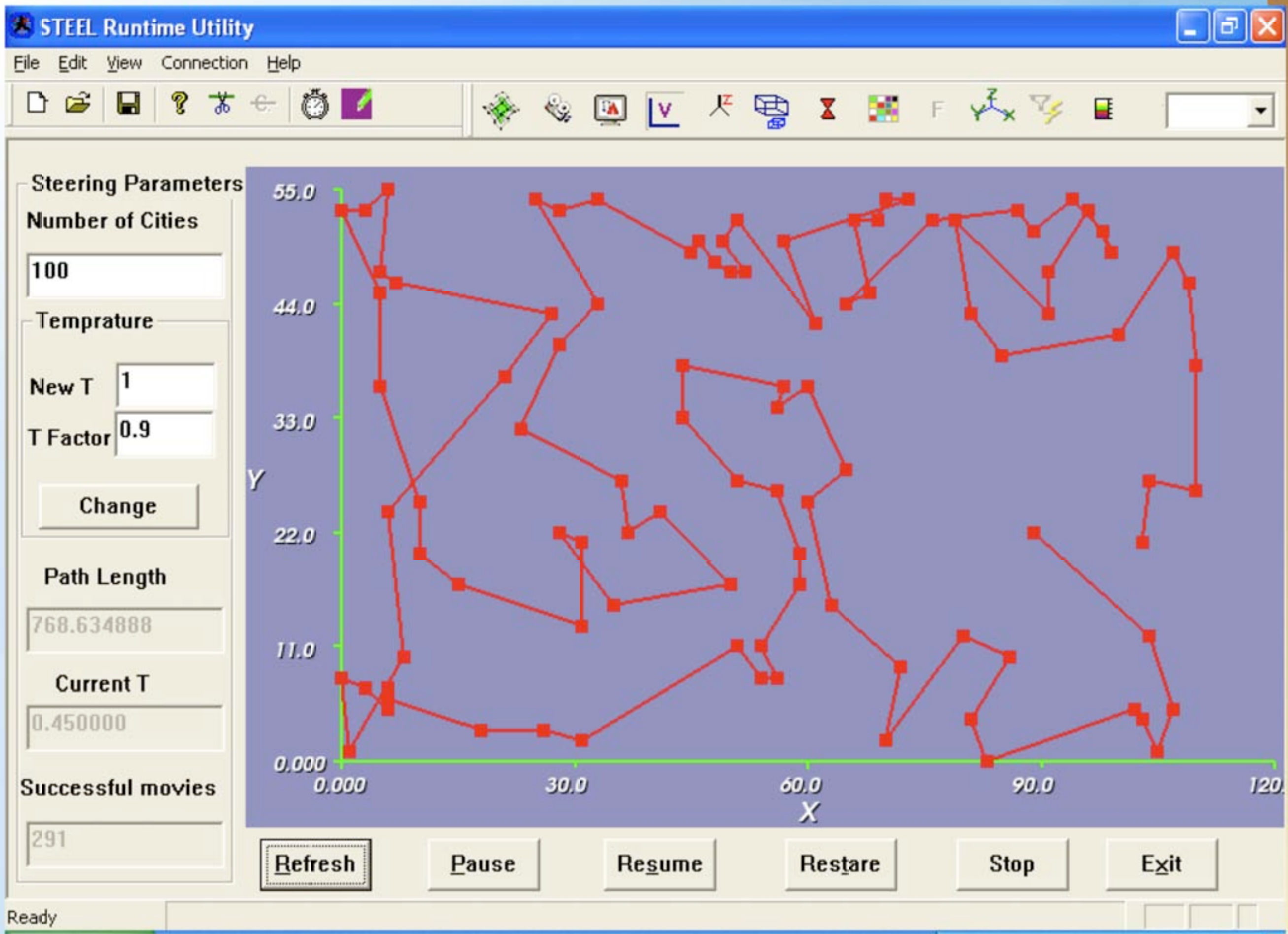

Intermediate Path

The traveling salesman problem using simulated annealing Algorithm

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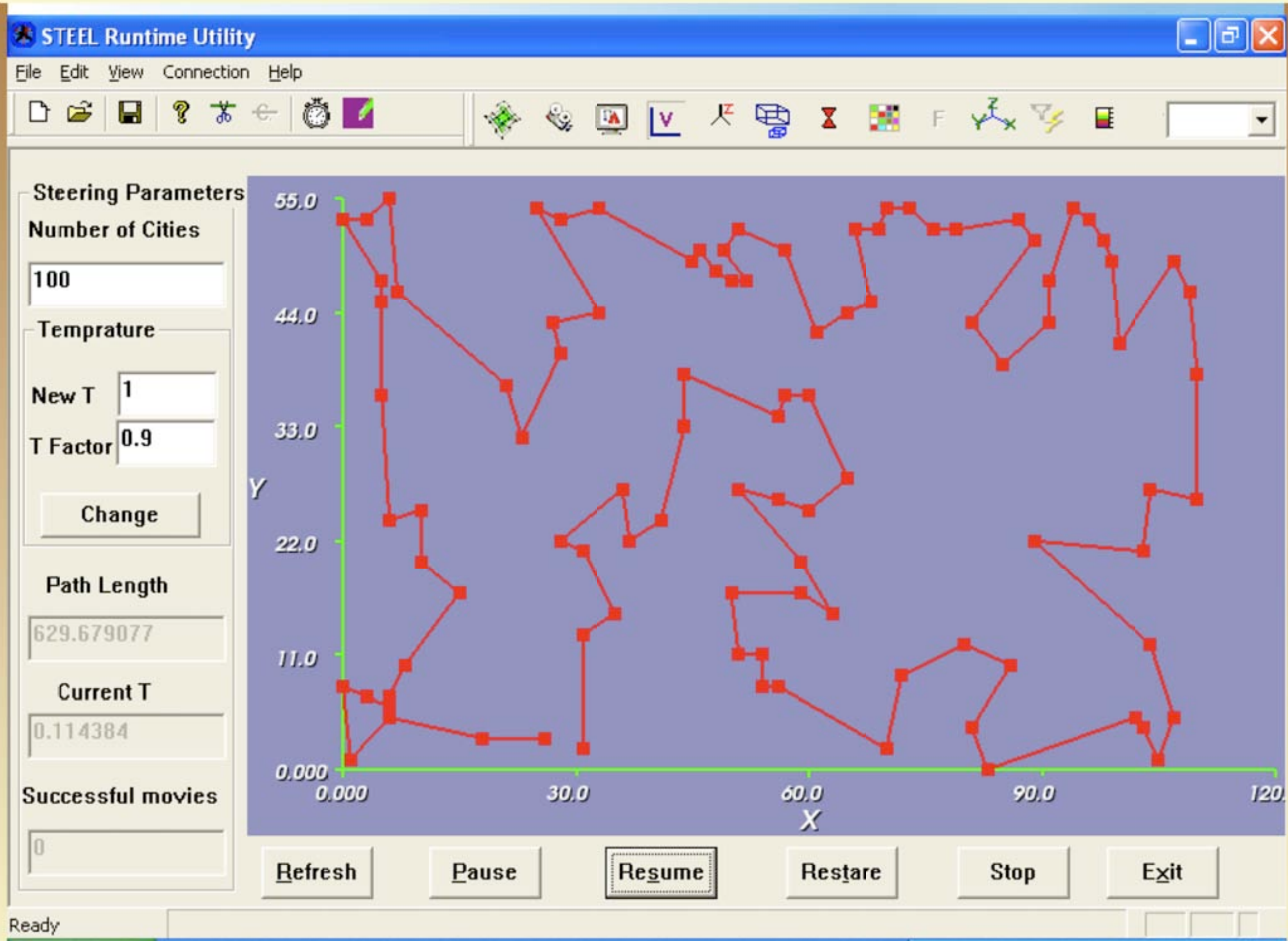

Final Path

The traveling salesman problem using simulated annealing Algorithm

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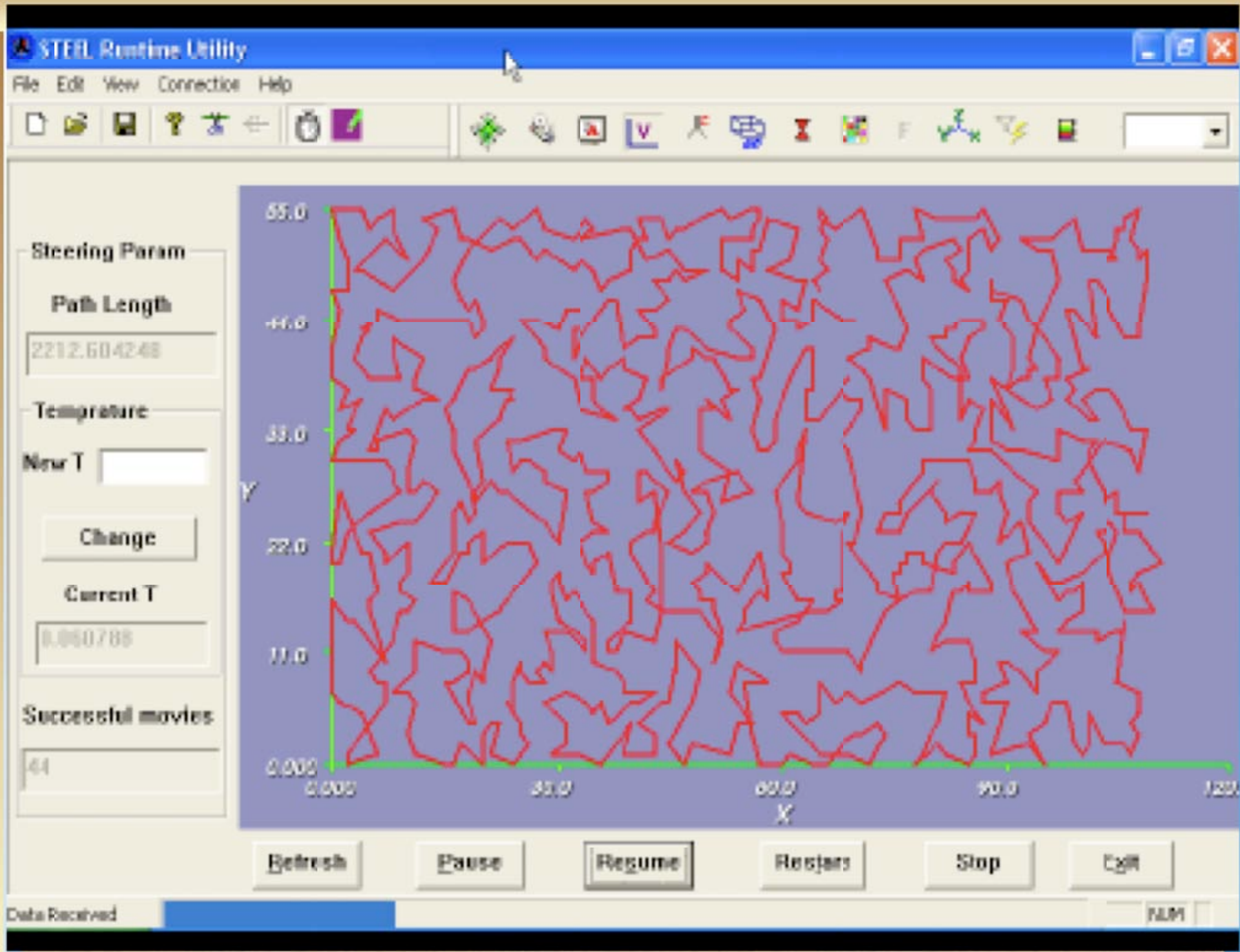
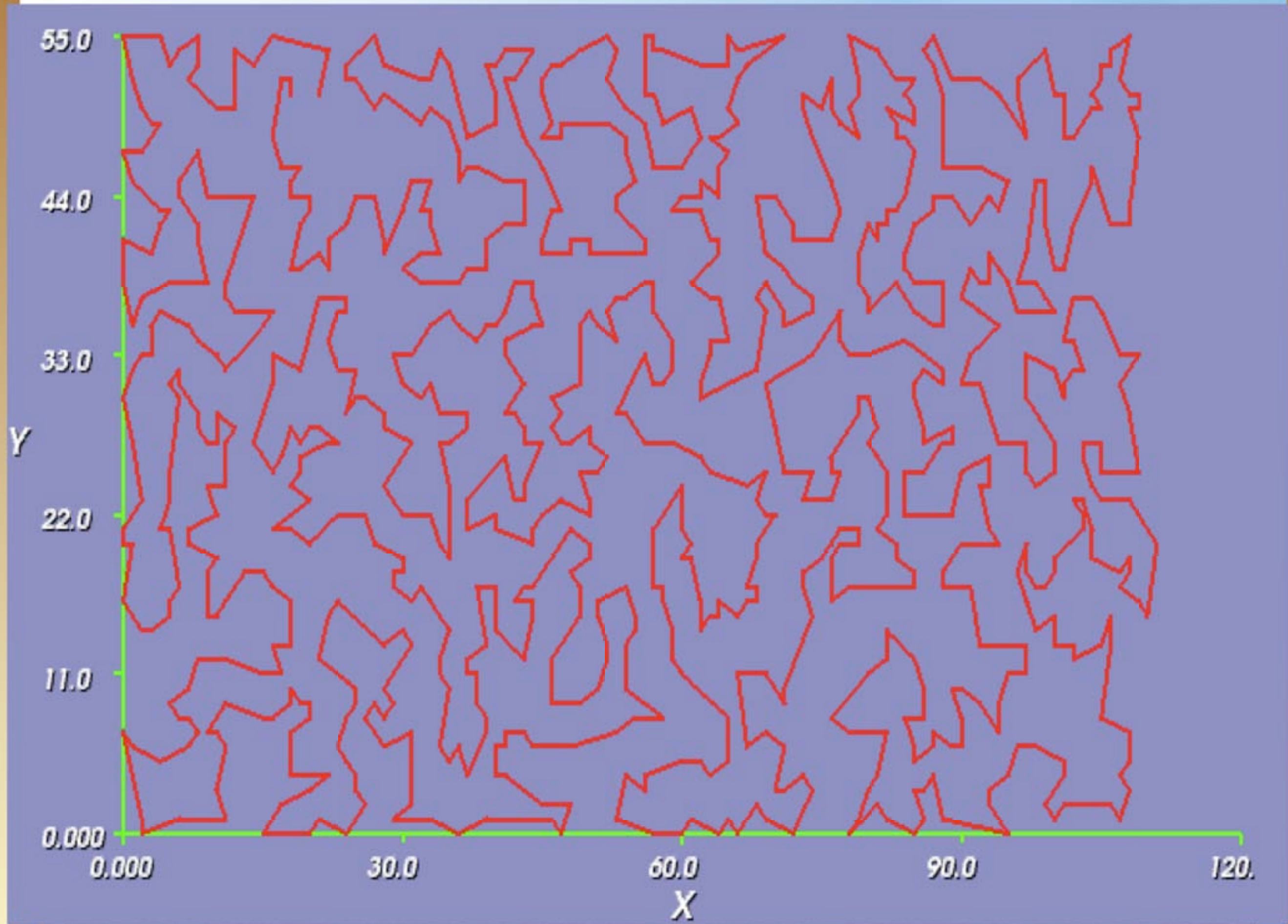


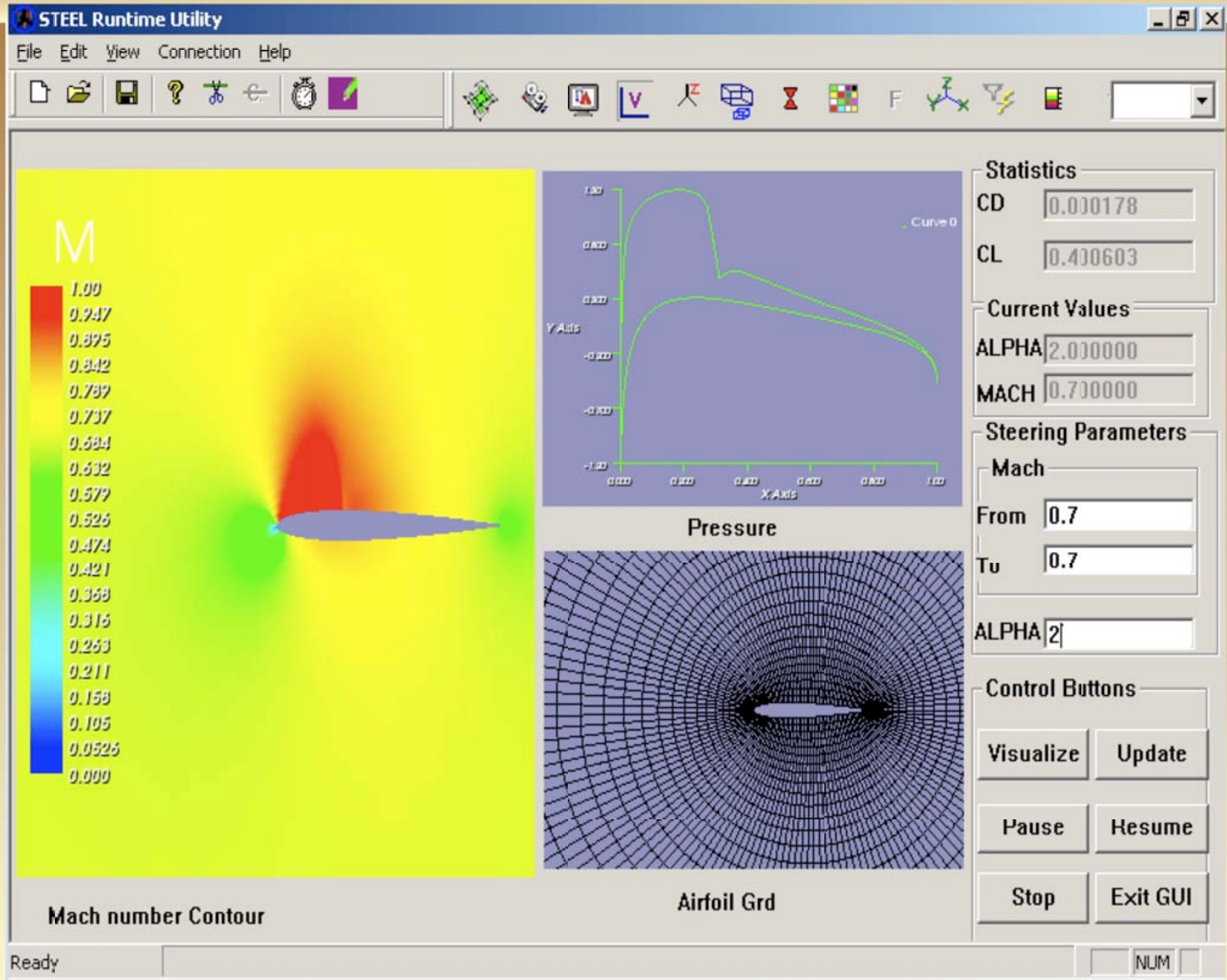
Movie Demonstrating STEEL While Working

The traveling salesman problem using simulated annealing Algorithm



Movie produced using STEEL

Numerical flow Simulation and Visualization past an Airfoil at Transonic Speeds



Numerical flow Simulation and Visualization past an Airfoil at Transonic Speeds

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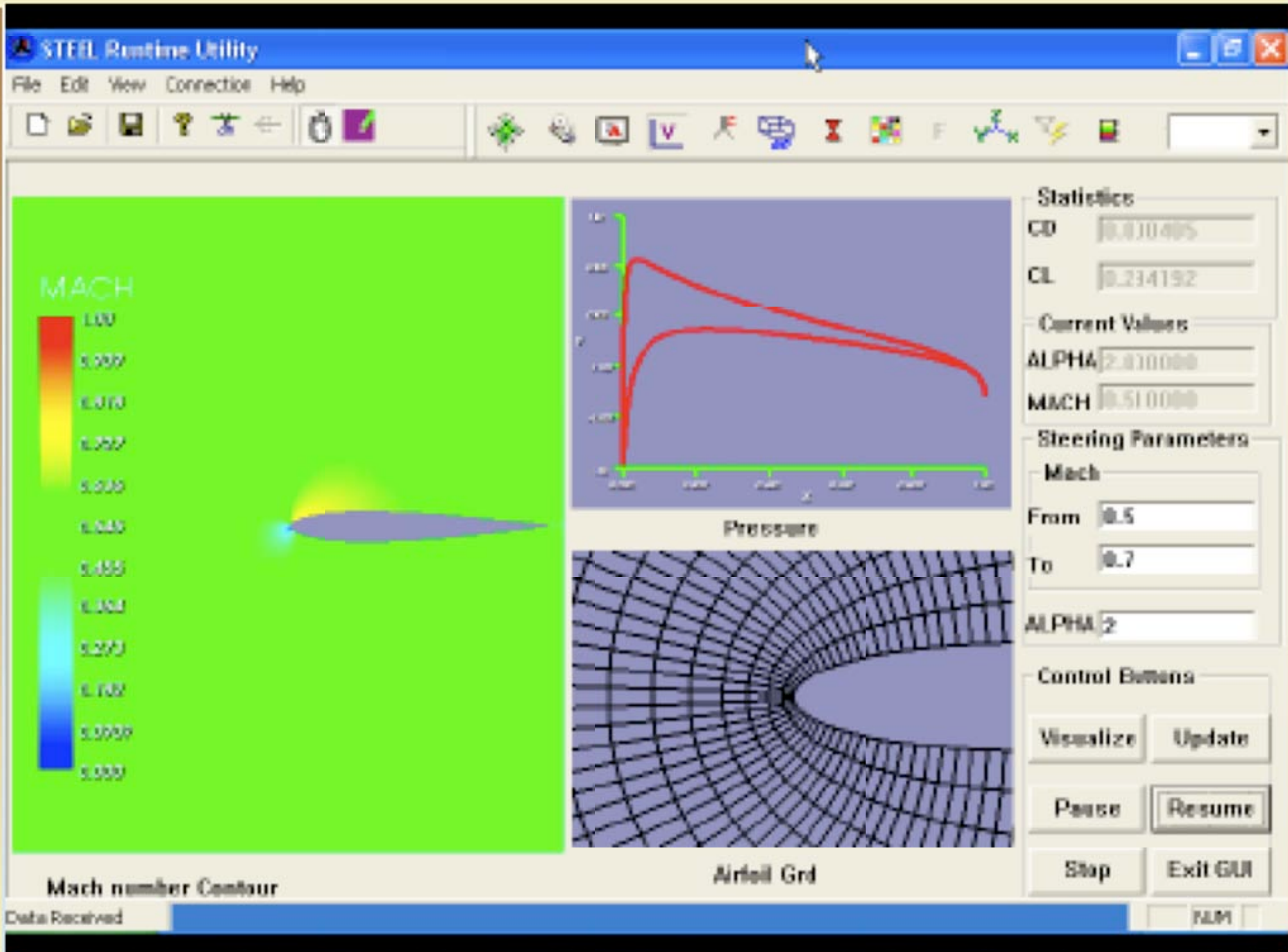

Movie Demonstrating STEEL While Working

Numerical flow Simulation and Visualization past an Airfoil at Transonic Speeds

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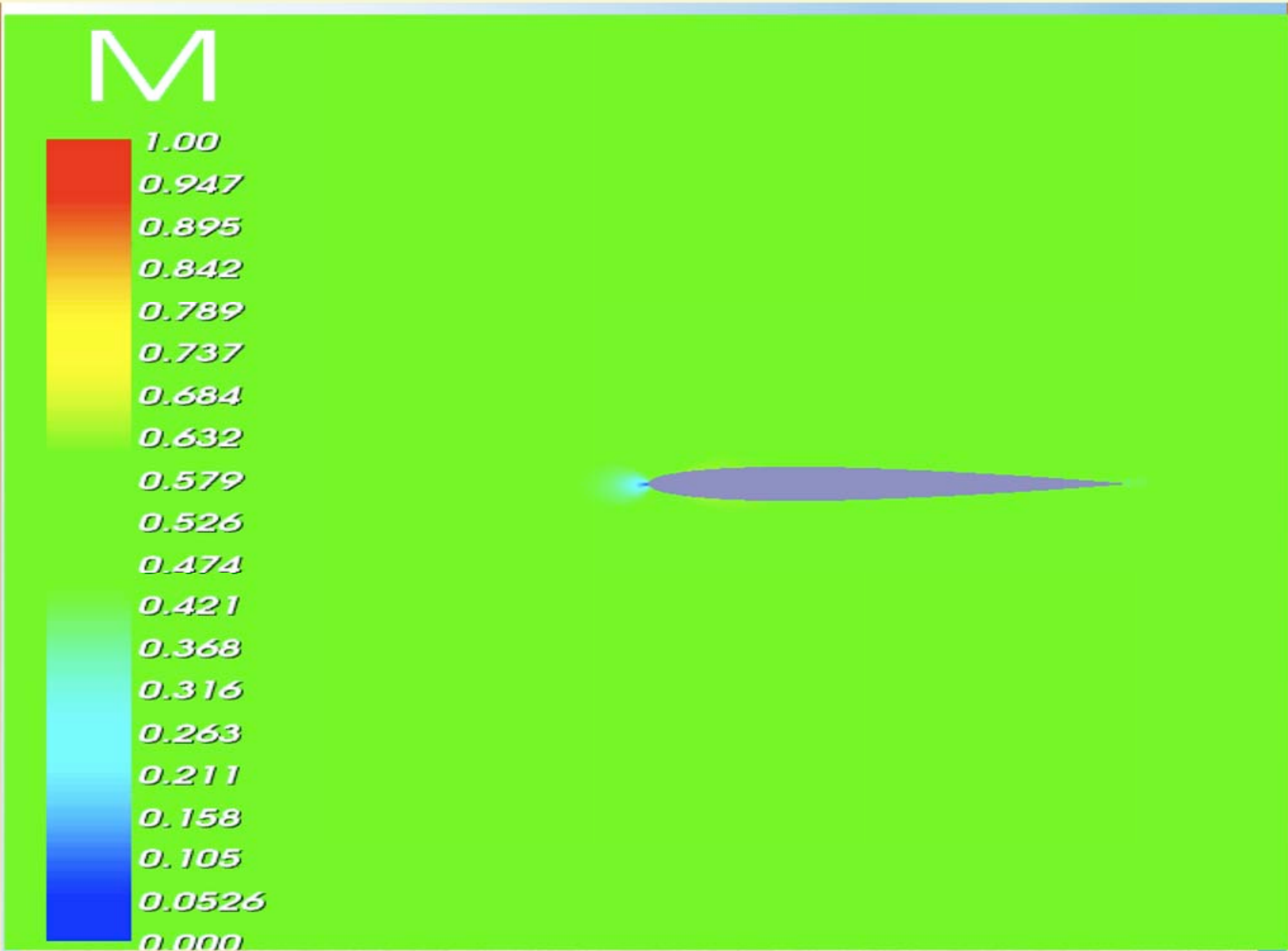

Movie produced using STEEL

Image Analogies – Image Colorization

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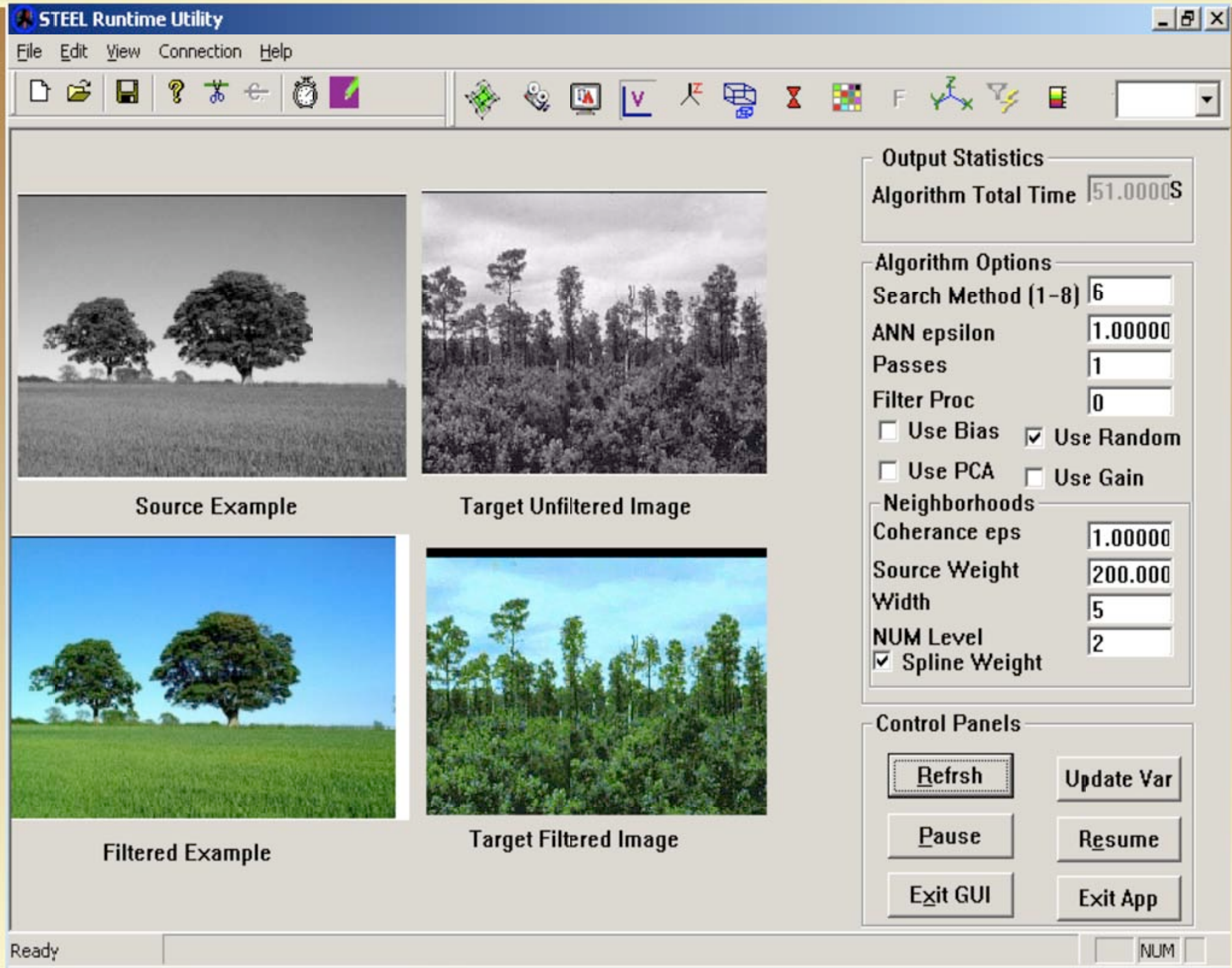
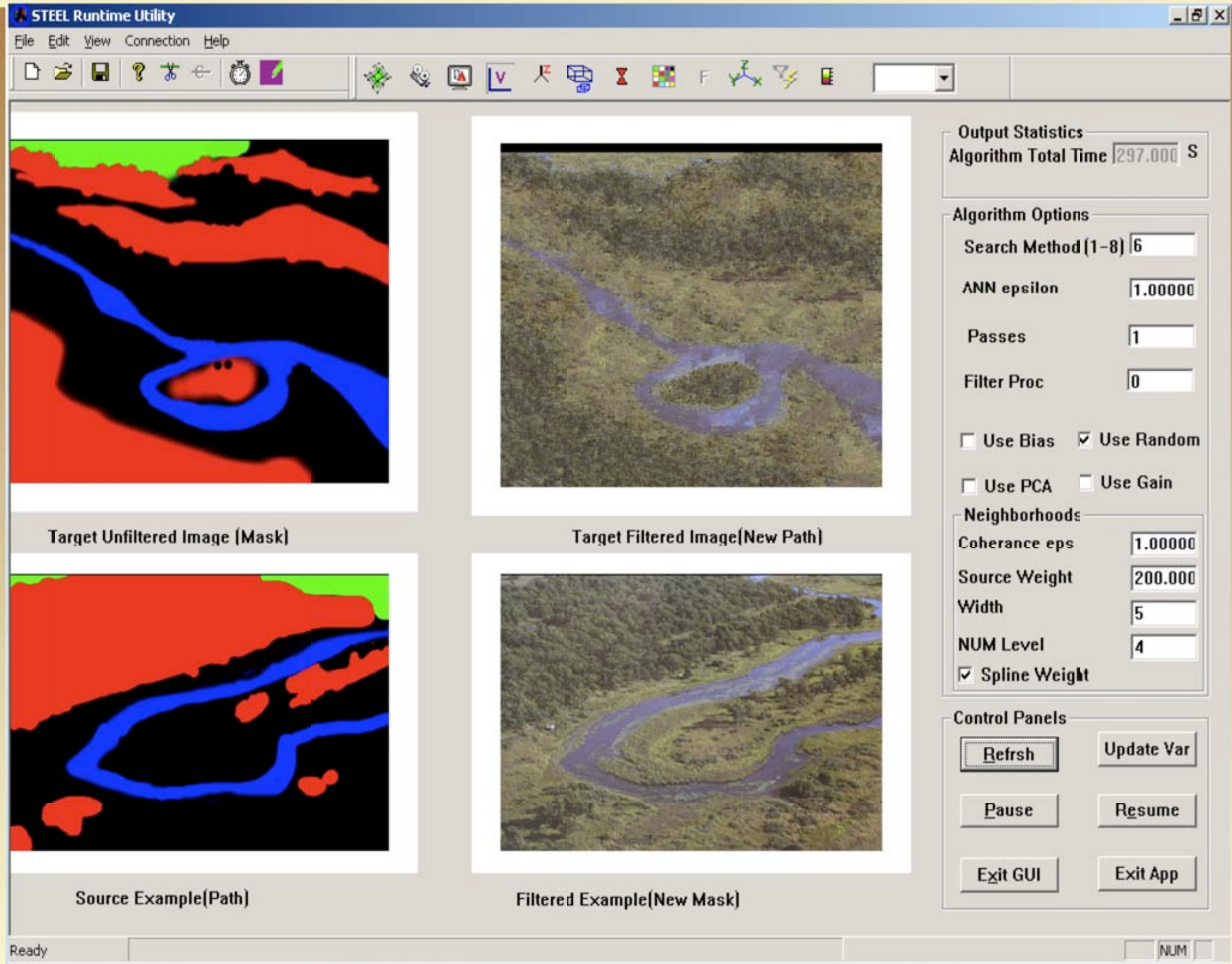


http://mrl.nyu.edu/projects/image-analogies/

Image Analogies- Texture by Numbers



Conclusions and Future Work

- We developed a framework for computational steering environments that can be used in electronic learning.

- We implemented this framework and the result is STEEL.

Conclusions and Future Work

- STEEL includes collaborative distributed interactive simulation, computational steering, and interactive visualization.

- Future extension of STEEL will focus on the addition of animation capabilities in virtual education environment.

Publications

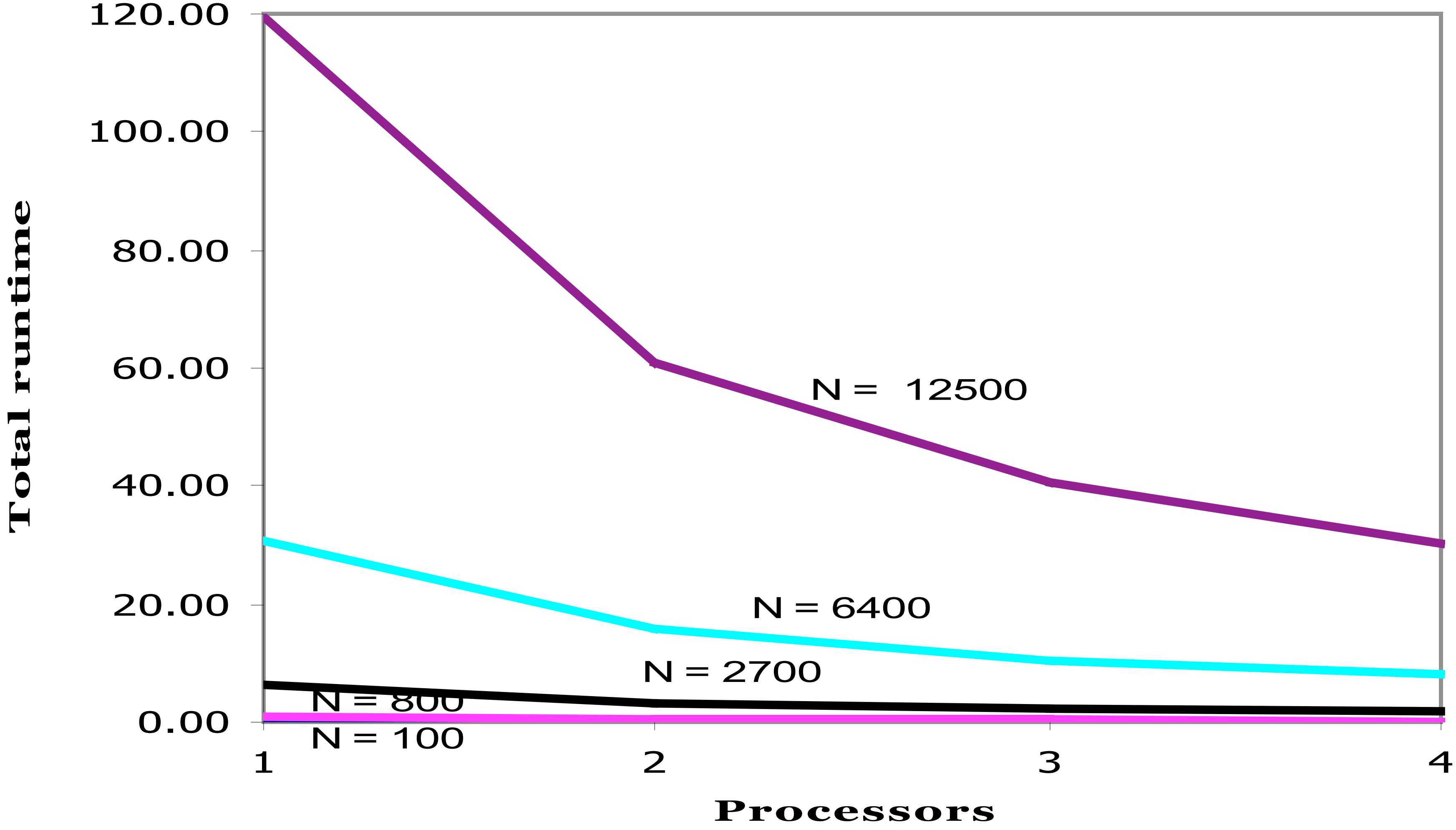
- M. Herajy, B. Eldesouky, and E. Atta , collaborative and distributed electronic learning through interactive simulation and steering, proceeding of the 5th international internet education conference , september 2006, cairo, egypt.
- M. Herajy, B. Eldesouky, and E. Atta, A distributed computational steering environment for electronic learning applications, proceeding 3rd international conference on intelligent computing and information systems, 2007, cairo, egypt.

Thank You

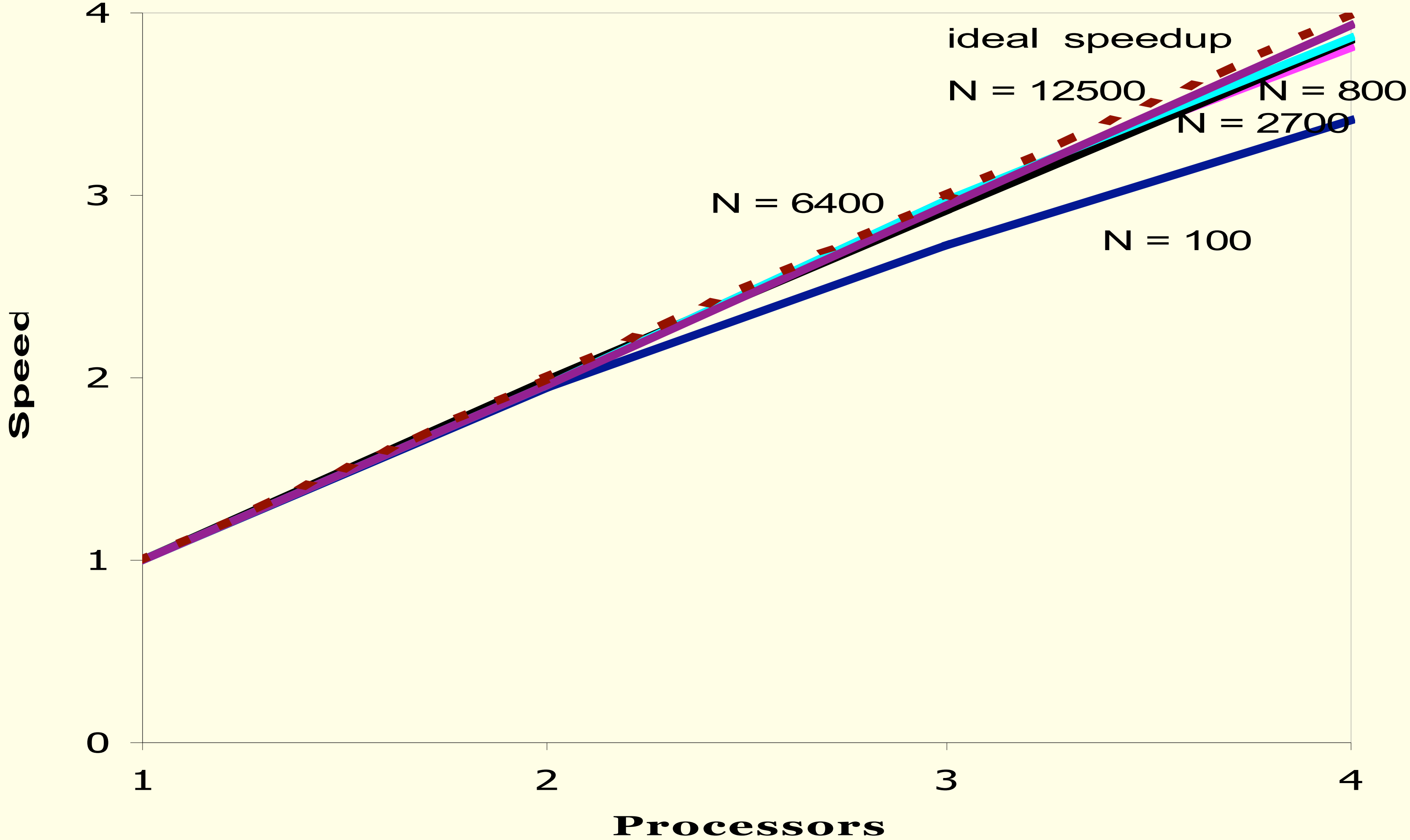
Comparison with other systems

Environment	Distributed	Allow Parallelism	Scope: Model Exploration	Scope: Algorithm experimentation	Scope: Performance optimization	User Interface	Fault toleranceand Backtracking	Application
CSE	YES	NO	YES	NO	NO	Visualization and steering through PGO	NO	
CUMULVS	YES	YES	YES	NO	YES	Visualization through AVS, textual steering	Fault tolerance	
SCIRun	YES	YES	YES	YES	NO	Steering through tcl/tk , visualization module	NO	
POSSE	YES	YES	YES	NO	NO	Use existing package for visualization	NO	
DISCOVER	YES	NO	YES	YES	NO	Web based visualization and steering	NO	
VASE	YES	NO	YES	YES	NO	Visualization through existing ,packages Steering through textual inputs	NO	
RealityGrid	YES	YES	YES	NO	NO		Backtracking	
Progress & Magellan	YES	NO	YES	NO	YES	Visualization through existing packages, steering through command line and GUI	NO	
STEEL	YES	YES	YES	YES	NO	Steering and visualization through dedicated client	Backtracking	E-learning

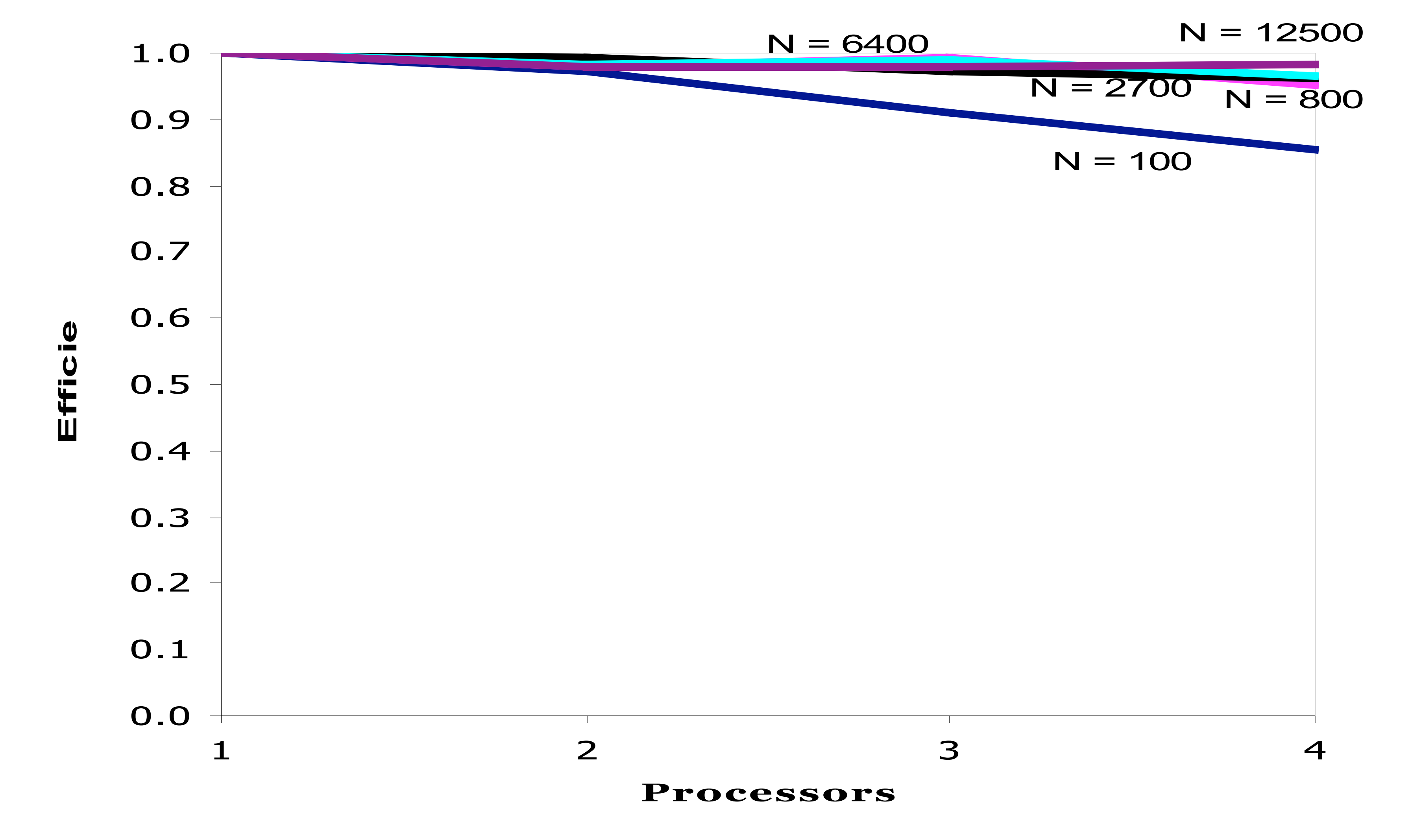
Total runtime as a function of the number of processors



Speedup as a function of the number of processors



Efficiency as a function of the number of processors



The performance analysis with fixed problem size