# Solving Nonlinear Equations of One Variable

by

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of the requirements for the degree of
Doctor of Philosophy
(Aerospace Engineering)
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Doctoral Committee:

Professor James F. Driscoll, Chair
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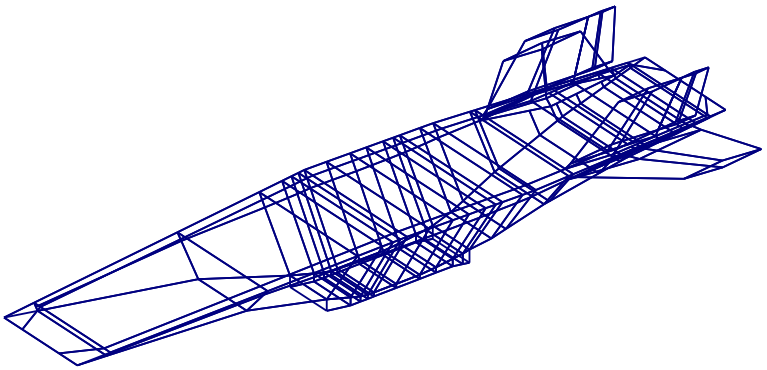

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2012

This dissertation is in honor of Adlai Stevenson and William Jennings Bryan, who were both twice the Democratic nominee for President of the United States without winning either time. As an interesting side note, Adlai Stevenson's grandfather, Adlai E. Stevenson I, was William Jennings Bryan's running mate in the 1900 election.

## A C K N O W L E D G M E N T S

It is imperative that I thank all of the authors of the dissertation template from the Department of Atmospheric, Oceanic and Space Sciences, which is available online at http://aoss.engin.umich.edu/. To my knowledge, the authors of that template include Jin Ji, Roque D. Oliveira, and Jason Gilbert. I also must thank Sara Spangelo for suggesting that this template be ready by the end of April 2011.

## *Preface*

The text of this document is of course mainly meant to show how the template works. The topic is thus a basic problem which has been solved in a great number of ways. This sample topic, which is solving equations of one variable using iterative techniques, allows us to use sample equations and figures so that we can see how they will look in this template. In addition to this subject, the text also serves as a very unusual users' manual. The second chapter, which does not match the other chapters at all, gives instructions on the actual commands that are used with this template.

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**CFD** Computational Fluid Dynamics

# ABSTRACT

**Solving Nonlinear Equations of One Variable**

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**Chair: James F. Driscoll**

We show that it is possible to get approximate solutions to analytically intractable equations using iterative methods. Thus we show that the author could pass an undergraduate class in numerical analysis. In addition, a unique extension to Brent's method is proposed that results in slight improvements in convergence.

# Chapter 1

# Introduction

The first part. For example in Computational Fluid Dynamics (CFD), which gives me a nice example of an abbreviation to demonstrate, the equation of state cannot be solved analytically when a perfect gas is not assumed.

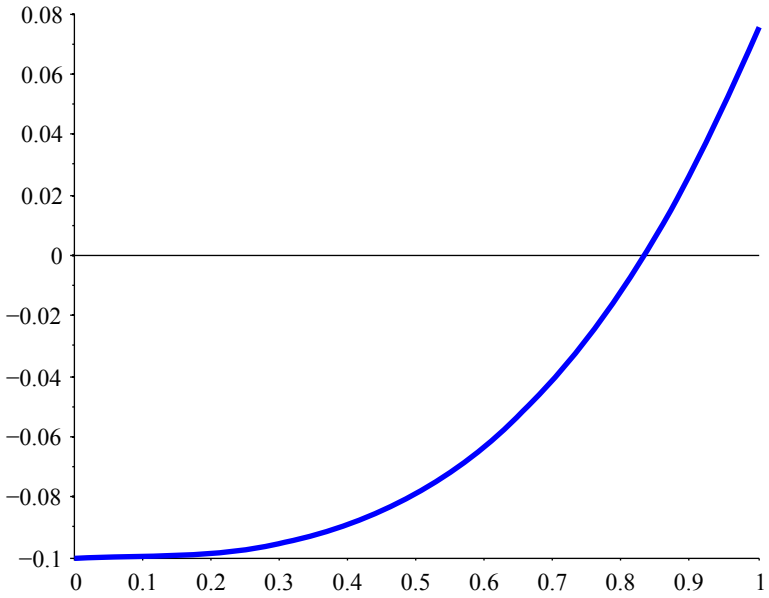


Figure 1.1: An example of a search function

And this should at least continue onto a second page. There are many texts that have a section on the subject, for instance [1].

# Chapter 2

# Using This Template

This chapter is stuck among the others as a brief users' manual for this template.

## 2.1 General Usage

The way to invoke usage of this template is to put

```
\documentclass{thesis-umich.cls}
```

at the beginning of your preamble. This can also work if the thesis-umich.cls file is not in the same directory as your .tex file. To do so, just give the relative path.

```
\documentclass{./tex/thesis-umich.cls}
```

# Chapter 3

# Setting

The second chapter has the good stuff.

## 3.1 Convergence Criteria

Actually, it might have the worst stuff. But it is slightly easier to write than the material in Chapter 1.

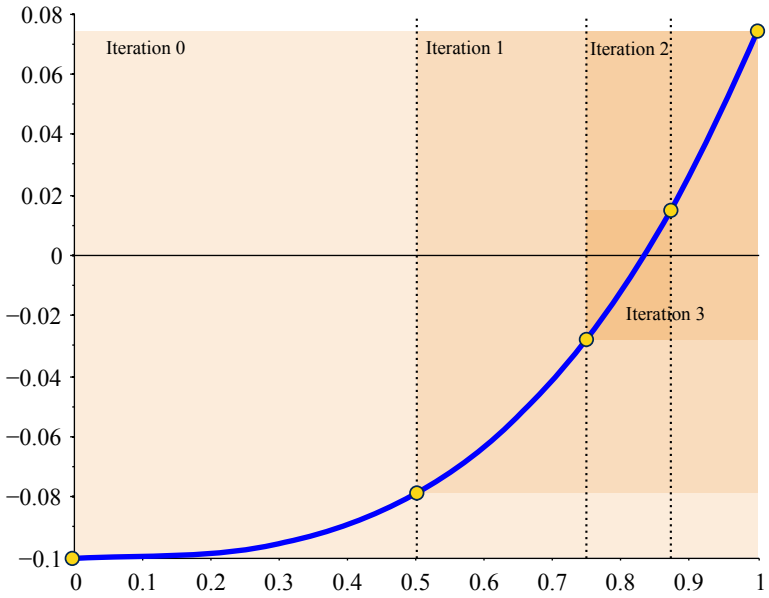


Figure 3.1: Illustration of $x$- and $y$-tolerances for bisection iterations

It takes very little text to fill a page in this format, but there is even less text on most of these sample pages.

## 3.2 Why we are doing it

It is usually a good idea to give reasons for your research. If you do not, the people who payed you to waist all that time will feel really bad about it, and then they will not provide the same opportunity to future students.

I need this page to see what even-numbered pages look like.

# Appendix A

# Methods

Here is how to implement the methods.

## A.1 Bisection

The easiest method.

$$x_k = \frac{a_k + b_k}{2} \tag{A.1}$$

## A.2 False Position

The next one.

```
(A map of the United States)
```

Program A.1: Map of the United States

# BIBLIOGRAPHY

[1] Chapra, S. C. and Canale, R. P., *Numerical Methods for Engineers*, McGraw-Hill, 4th ed., 2002.