

Lecture Module - Nonlinear Equations

ME3001 - Mechanical Engineering Analysis

Mechanical Engineering

Tennessee Technological University

Topic 3 - The Secant Method

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- Analytical vs. Numerical
- Automating Newton-Raphson
- Modified Newton-Raphson
- The Finite Difference

Analytical vs. Numerical

Analytical

- solution to a problem that can be written in **closed form**
- solution in terms of known functions, constants, etc.
- gives an **exact answer**

Numerical

- an **approximation** to the solution of a mathematical equation
- iterative procedure or algorithm
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Automating Newton-Raphson

Our goal is to write a computer program to automate the Newton-Raphson method. We want our program to be (1) robust to different inputs and (2) user friendly.

Automating Newton-Raphson

The Newton-Raphson method is not **purely numerical**, why?

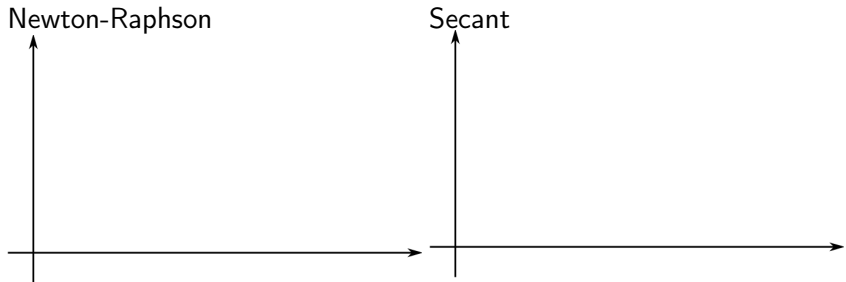
- The Equation
- The Derivation

How can we avoid this issue?

Hint: Think about the title **secant** ...

Modified Newton-Raphson

The **secant** method is a modified version of the Newton-Raphson method.



Modified Newton-Raphson

The **secant** method is a modified version of the Newton-Raphson method.

What are the benefits?



Are there tradeoffs?



The Finite Difference

This idea or technique is the foundation of a family of methods known as the *Finite Difference Methods*.

