section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
1985 بد يوعياف - المسيلة Université Mehamed Bo	People معمد معمد oudiat - Msila	e's Democrat nistry of Hig Scientifi	ic Republic of her Education c Research	f Algeria and	Home Bank and Market
	tl	ie title o	f the arti	cle	
		Prese	nted by :		

you

your industry

May 21, 2025

section 1 000	section2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

• introduction

- ۲
- ٠
- •
- •
- •
- •

section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					
I I GI I					

• introduction

- theorotical foundation
- ۲
- •
- •
- •

section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					
I I GI I					

- introduction
- theorotical foundation
- applying the methods
- ۲
- ۲
- •
- -
- ۲

section 1 000	section2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

- introduction
- theorotical foundation
- applying the methods
- Comparison of Results
- ۲
- •
- •

section 1 000	section2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

- introduction
- theorotical foundation
- applying the methods
- Comparison of Results
- Limitations and Improvements
- ۲
- ٥

section 1 000	section2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

- introduction
- theorotical foundation
- applying the methods
- Comparison of Results
- Limitations and Improvements
- Real-World Applications

۲

section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

- introduction
- theorotical foundation
- applying the methods
- Comparison of Results
- Limitations and Improvements
- Real-World Applications
- Conclusion

section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion 0000
Plan					

- introduction
- theorotical foundation
- applying the methods
- Comparison of Results
- Limitations and Improvements
- Real-World Applications
- <u>Conclusion</u>

section 1 section 2 section 3 section 4 section 5 Conclusion 0000 why this topic exactly

scientists and engineers used to face challenges when repeatedly trying to find the roots of functions, especially the long and complicated ones that can take a lot of time and energy. with that, we present two algorithms that help to find the root of the function called Fixed-Point method and Dichotomy Method, both of these method are designed to speed up and simplify this process.

section 1	section 2	section3	section 4	section 5	Conclusion
●00		00000	00	00	0000

Theorotical Foundation



Dichotomy

ideas it Finds the roots by shrinking the interval by half. it uses the intermediate value theoreme.

algorithm

- check if $f(a) \cdot f(b) < 0$.
- calculate the midpoint $c = \frac{a+b}{2}$.
- update interval based on f(c)

convergence : linear without any condition



theorotical foundation

Fixed-point

ideas

1 it uses the convergence

2 it turns
$$f(x)$$
 to $x = g(x)$

algorithm

• check
$$g(x)$$
 when $|g^{\prime}(x)| < 1.$

•
$$x_{n+1} = g(x_n)$$

convergence: Quadratic under some conditions.

section 1	section2	section3	section 4	section 5	Conclusion
000	●00	00000	00	00	0000

applying the methods



applying the methods

Dichotomy

user inputs

• function
$$f(x) = cos(x) - x$$

• interval
$$[0,1]$$

• epsilon
$$\varepsilon = 10^{-7}$$

Outputs

- Result: 0.739085
- Iterations: 24





applying the methods

Fixed-point

user inputs

• function
$$g(x) = cos(x) \quad \Leftarrow \quad f(x) = cos(x) - x$$

• first value
$$x_0 = 0.5$$

• epsilon
$$\varepsilon = 10^{-7}$$

Outputs

- Result: 0.739085
- Iterations: 39



section 1	section2	section3	section 4	section 5	Conclusion
000	000	●0000	00	00	0000

Comparison of Results



Comparison of Results









Comparison of Results

Dichotomy MATLAB duration : 0.0147928_s C duration : 0.0000072_s iteration : 24 MATLAB duration : 0.0000049_s iteration : 39



MATLAB

- MATLAB duration : 0.0147928_s
- C duration : 0.0000072_s
- \bullet iteration : 24

С

- MATLAB duration : 0.0086337_s
- C duration $:0.0000049_s$
- iteration : 39

↑ Comparison ↑

• C is 2000X faster than MATLAB

section 1	section 2	section3	section 4	section 5	Conclusion
000	000	00000	●○	00	0000

Limitations and Improvements

Limitations and Improvements

Dichotomy Method • Limitations: • Slow convergence • Requires sign change • Needs initial bracketing • Fixed-Point Method • Limitations: • May diverge • needs 2 variables (x_{k+1}) and x_k • Requires |g'(x)| < 1

↑ improvement ↑

- Use dichotomy for initial bracketing
- Switch to fixed-point when close to solution

section 1	section 2	section3	section 4	section 5	Conclusion
000	000	00000	00	●○	0000

Real-World Applications



Real-World Applications

Engineering Applications

- Structural equilibrium analysis
- Control system stability points

Other Basic Applications

- Optimisation
- confirming your calculation

Chemistry Applications

- pH level calculations
- Reaction equilibrium points

Economics Applications

- Market equilibrium models
- Optimal pricing strategies

section 1	section2	section3	section 4	section 5	Conclusion
000	000	00000	00	00	●000

Conclusion

section 1 000	section 2 000	section3 00000	section 4 00	section 5 00	Conclusion ○●○○
Conclus	sion				

Key Findings

Dichotomy Method:

- Accurate but slow (linear convergence)
- Guaranteed convergence with sign change

• Fixed-Point Method:

- Faster when conditions are met
- Sensitive to function choice

Implementation:

- MATLAB easier for prototyping
- C superior for performance
- future Direction
 - GPU acceleration on machine learning

section 1 000	section 2	section3 00000	section 4 00	section 5 00	Conclusion 00●0		
referrences							

referrences

- Burden, Richard L., and J. Douglas Faires. Numerical Analysis. 9th ed. Boston: Brooks/Cole, 2011.
- Chapra, Steven C., and Raymond P. Canale. Numerical Methods for Engineers. 7th ed. New York: McGraw-Hill, 2015.
- MathWorks. MATLAB Documentation: Root-Finding Algorithms. 2025. Accessed May 21, 2025.
- Free Software Foundation. GNU C Library Manual: Mathematical Functions. 2025. Accessed May 21, 2025.

section 1	section 2	section3	section 4	section 5	Conclusion
000	000	00000	00	00	○○○●

Thank You for listening

Presented by: me University of M'sila - Department of Mathematics May 21, 2025