



MITx CSE.0002x

Introduction to Computational Science and Engineering



[Help](#)


sandipan\_dey ▾


- [Course](#)
- [Progress](#)
- [Dates](#)
- [Discussion](#)
- [MO Index](#)


[🏠](#) [Course](#) / [11 Nonlinear Differential Equations and R...](#) / [11.2 Scalar nonlinear IVP and ro...](#)


< Previous











Next >

# 11.2.2 Bisection method

 Bookmark this page

MO2.10

One of the most common methods for root finding in a scalar equation is the bisection method. The bisection method starts from two points  $a^0$  and  $b^0$  such that either

$$r(a^0) > 0, \quad \text{and} \quad r(b^0) < 0.$$

or

$$r(a^0) < 0, \quad \text{and} \quad r(b^0) > 0.$$

When  $r$  is continuous, there must exist a root in the interval  $[a^0, b^0]$ . At stage  $k$ , assume that we have obtained an interval  $[a^k, b^k]$  such that the same sign properties hold, i.e.  $r(a^k)$  and  $r(b^k)$  have opposite signs. The bisection method consists in subdividing the interval  $[a^k, b^k]$  in two and keeping the half in which there must be a root. Let  $m^k = (a^k + b^k)/2$ . The key concept to deciding which half to keep is to determine whether  $r(m^k)$  has the opposite sign as  $r(a^k)$  or  $r(b^k)$ . This can be done by multiplying  $r(a^k)r(m^k)$  and  $r(b^k)r(m^k)$  and checking the signs of these multiplications. When the sign is negative, then the corresponding  $r$  values have the opposite sign and there must still be a root between

© All Rights Reserved



corresponding  $x$  values.

Here's the bisection algorithm based upon this concept:



[About](#)

[Affiliates](#)

[edX for Business](#)

[Open edX](#)

[Careers](#)

[News](#)

[Terms of Service & Honor Code](#)

[Privacy Policy](#)

[Accessibility Policy](#)

[In Practice](#)

[Trademark Policy](#)

[Site Map](#)

[Code of Conduct](#)

[Your Privacy Choices](#)

[Your Privacy Choices](#)

[Terms of Service & Honor Code](#)

[Privacy Policy](#)

[Accessibility Policy](#)

[In Practice](#)

[Trademark Policy](#)

[Site Map](#)

[Code of Conduct](#)

[Your Privacy Choices](#)

Discussions

All posts sorted by recent activity

< Previous

Connect

Next >

[Blog](#)

[Contact Us](#)

[Help Center](#)

[Security](#)

[Media Kit](#)



© 2023 edX LLC. All rights reserved.

深圳市恒宇博科技有限公司 [粤ICP备17044299号-2](#)

Video on bisection method and its application

[Start of](#)

