भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

MA 423: Matrix Computations Lab

Lab 04

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10 Sept 2021

Question 1.

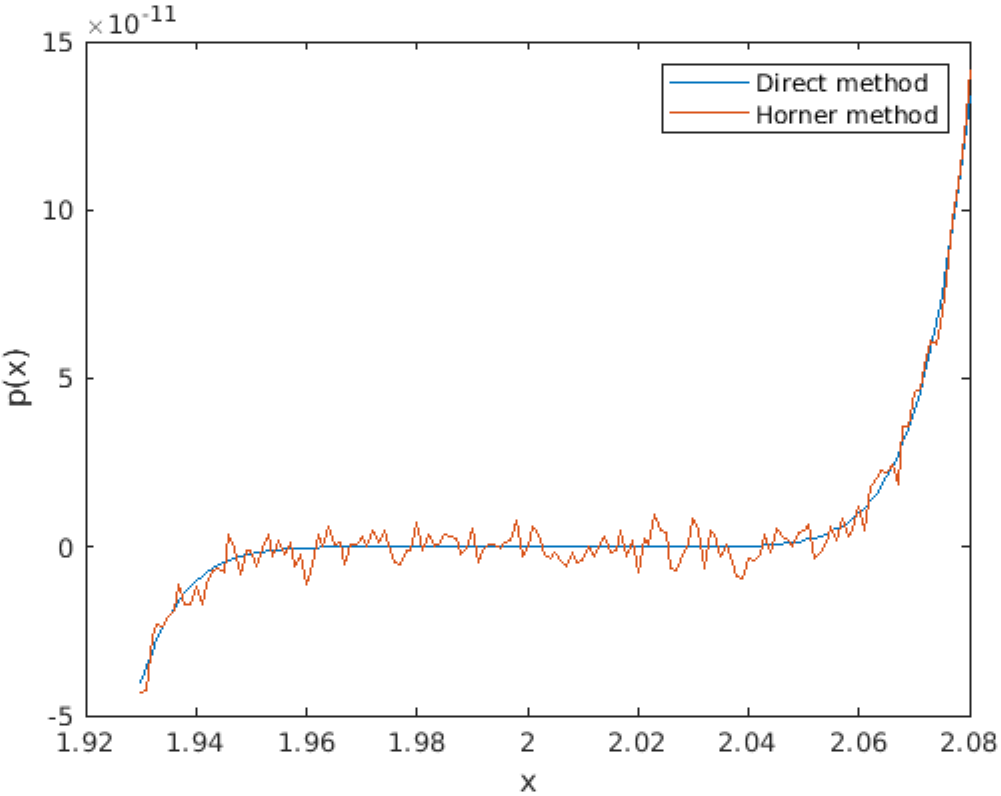
$p(z) = p_1 z^n + p_2 z^{n-1} + \cdots + p_n z + p_{n+1}$

- Horner's method utilizes the following trick to calculate p(z) in *O(n)* time.
  $p(x) = p_{n+1} + x(p_n + \cdots + x(p_3 + x(p_2 + p_1 x)))$
- The function program y = Horner(p,x) has been written which uses Horner's rule to evaluate p(z) at z=x.

Question 2.

Different intervals were taken in [1.95, 2.05]. Roots were obtained with a tolerance of 10^-8 and were never equal to 2.

Question 3.



Yes, the plots differ from each other. The reason for question 2 is as follows:

During the evaluation of p(x) using Horner’s method, rounding errors were committed, and they are pushing small negative p(x) values to be positive and other positive values to negative ones in the neighborhood of 2.

This is causing the graph to cross the x-axis in many places other than 2 computationally. So although theoretically, there are 9 roots at 2, computationally there will be others in small neighborhoods of 2; some even in intervals near 2, but not containing 2.