Homework Feedback 13

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**P. 301 #5** Derive Eq. (S.33) by the following method. Set:

Expand , and in Taylor series about , equate the coefficients of , , to obtain a,b and c.

**Answer:** Let us do the Taylor expansion:

Equate the coefficients of , , , we get: a = , b = , c=

**P. 323 #5** Repeat Exercise 2 using the algorithm developed in Exercise 3.

**Answer:** For high-order differential equations, we need to first convert it into first order differential equations with auxiliary variables.

Take the question **a** as an example:

1. actual solution is:

.

**First step: convert the original equation into first-order equations:**

Let then we have:

The initial values are ( this corresponds to ).

**Second step: solve these two differential equations with the given IVP algorithm:**

For example, to use the Adams-Bashforth Four-Step Explicit Method:

we need to reform the equation to solve the above first-order equations:

,, the other terms can be transformed into the vector in the same way.

In case you donot understand why the equation can be formed this way, I show you the relationship here:

We can then compute :

|  |  |  |
| --- | --- | --- |
|  |  | Error |
| 0 | 0 | 0 |
| 0.1 | 0.00009 | 0 |
| 0.2 | 0.0001535 | 0 |
| 0.3 | 0.000834 | 0 |
| 0.4 | 0.002832 | 1x10-6 |

……

**P. 334 #7** Investigate stability for the difference method:

for , with starting values .

**Answer:** The characteristic polynomial for the difference method is:

The root of the polynomial is 2+i,. 2-i. Hence, it is not stable.