Numerical Analysis

Homework 12. RLC Circuit.

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1. Objective

The RLC circuit is shown below.

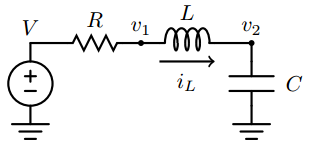


Figure . RLC circuit

Using these equations to solve , and :

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,

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And assuming

1. ,
2. ,
3. Approach
   1. Forward Euler Method

So the problem will become

,

,

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* 1. Backward Euler Method

So the problem will become

,

,

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* 1. Trapezoidal Method

So the problem will become

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* 1. Algorithm

|  |
| --- |
| **Algorithm.** Methods for solving ODEs with a given initial value. |
|  |

1. Results
   1. Plot

|  |  |
| --- | --- |
| **h=0.1** | **h=0.01** |
| **Forward Euler** | |
|  |  |
| **Backward Euler** | |
|  |  |
| **Trapezoidal** | |
|  |  |

Table .

* 1. Maximum and minimum

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **h=0.1** | | | **h=0.01** | | |
| **Forward Euler** | | | | | | |
|  |  |  |  |  |  |  |
| **max** | 1.1139 | 1.19627 | 0.581654 | 1.09125 | 1.16602 | 0.549617 |
| **min** | 0.418346 | 0 | -0.11391 | 0.450383 | 0 | -0.09125 |
| **Backward Euler** | | | | | | |
|  |  |  |  |  |  |  |
| **max** | 1.07026 | 1.13651 | 0.515275 | 1.08694 | 1.16011 | 0.543012 |
| **min** | 0.484725 | 0.009009 | -0.07026 | 0.456988 | 9.9e-05 | -0.08694 |
| **Trapezoidal** | | | | | | |
|  |  |  |  |  |  |  |
| **max** | 1.08936 | 1.16346 | 0.546816 | 1.08907 | 1.16304 | 0.546298 |
| **min** | 0.453184 | 0.004751 | -0.08936 | 0.453702 | 4.98e-05 | -0.08907 |

Table .

1. Observations
   1. Different in method (same in h, variable)

|  |  |
| --- | --- |
| h=0.1 | h=0.01 |
|  |  |
|  |  |
|  |  |

Table .

* 1. Different in h (same in method, variable)
* **Forward Euler**

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|  |
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|  |

Table .

* **Backward Euler**

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Table .

* **Trapezoidal**

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Table .

* 1. Conclusion
* Amplitude

For h=0.1 and 0.01, from Table 2 and Table 3 we can obviously see the amplitude in damped oscillation region:

Forward Euler > Trapezoidal > Backward Euler

* + Forward Euler

From Table 2 and Table 4, the amplitude in damped oscillation region is smaller when h is smaller.

* + Backward Euler

From Table 2 and Table 5, the amplitude in damped oscillation region is larger when h is smaller.

* + Trapezoidal

From Table 2 and Table 6, the amplitude in damped oscillation region is smaller when h is smaller.