Solution of differential equation using MATLAB code description

1. r = linspace(5, 8, 100): It generates a linearly spaced vector ‘r’ with 100 elements ranging from 5 to 8.

2. dr = r(2) – r(1): This calculates the spacing between adjacent elements of ‘r’.

3. a = eye(100, 100): It initializes a 100x100 identity matrix ‘a’.

4. The `for` loop iterates from 1 to 98 (since the loop goes up to 98, the condition is `i <= 98` rather than `i < 98`).

5. Inside the loop, three coefficients, `ui_m1`, `ui`, and `ui_p1`, are calculated based on the finite difference method.

`ui_m1`: The coefficient corresponding to the value of ‘u’ at index (i-1).

`ui`: The coefficient corresponding to the value of ‘u’ at index ‘i’.

`ui_p1`: The coefficient corresponding to the value of ‘u’ at index (i+1).

6. The matrix ‘a’ is updated in each iteration to build the finite difference approximation for the entire ‘r’ range.

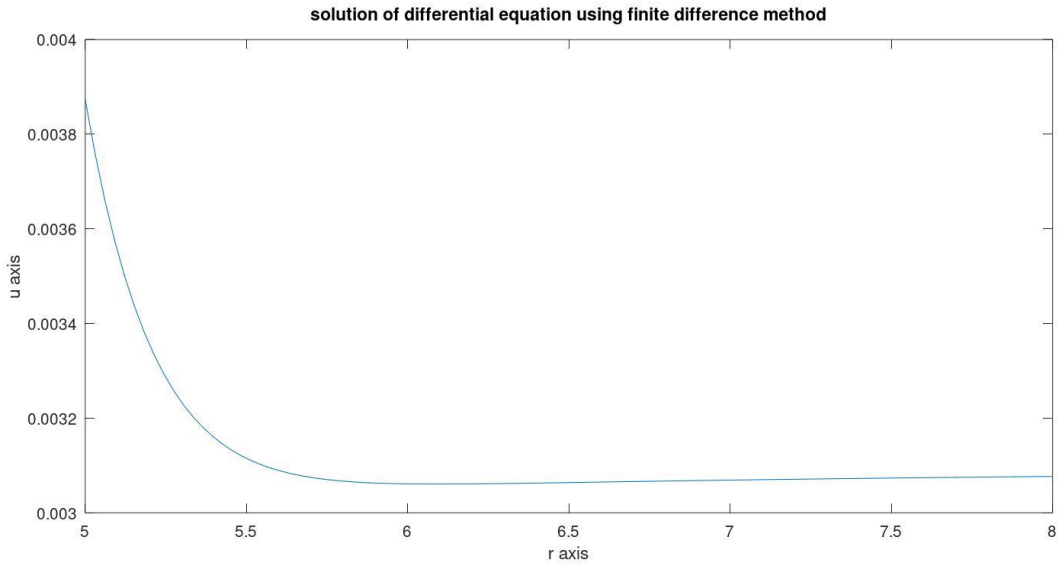
7. `c` is a 100x1 column vector that represents the right-hand side of the finite difference equation.

8. The boundary conditions `c(1)` and `c(100)` are set based on the given values of 0.0038731 and 0.0030769, respectively.

9. The matrix ‘a’ and vector ‘c’ are used to solve the system of linear equations for ‘u’ using the matrix inversion method (`u = inv(a) * c`).

10. Finally, the plot of ‘u’ against ‘r’ is generated using the `plot` function, and appropriate labels and title are added to the plot.

Output plot


solution of differential equation using finite difference method
0.004
0.0038
0.0036
0.0034
0.0032
0.003
u axis
5
5.5
6
6.5
7
7.5
8
r axis

Table

r	u	r	u	r	u
5	0.003873	6.1515	0.003061	7.303	0.003072
5.0303	0.00376	6.1818	0.003061	7.3333	0.003072
5.0606	0.003661	6.2121	0.003061	7.3636	0.003072
5.0909	0.003576	6.2424	0.003061	7.3939	0.003073
5.1212	0.003502	6.2727	0.003062	7.4242	0.003073
5.1515	0.003438	6.303	0.003062	7.4545	0.003073
5.1818	0.003383	6.3333	0.003062	7.4848	0.003073
5.2121	0.003336	6.3636	0.003063	7.5152	0.003074
5.2424	0.003295	6.3939	0.003063	7.5455	0.003074
5.2727	0.00326	6.4242	0.003063	7.5758	0.003074
5.303	0.00323	6.4545	0.003063	7.6061	0.003074
5.3333	0.003204	6.4848	0.003064	7.6364	0.003074
5.3636	0.003181	6.5152	0.003064	7.6667	0.003075
5.3939	0.003162	6.5455	0.003064	7.697	0.003075
5.4242	0.003146	6.5758	0.003065	7.7273	0.003075
5.4545	0.003132	6.6061	0.003065	7.7576	0.003075
5.4848	0.00312	6.6364	0.003065	7.7879	0.003076
5.5152	0.00311	6.6667	0.003066	7.8182	0.003076
5.5455	0.003102	6.697	0.003066	7.8485	0.003076
5.5758	0.003094	6.7273	0.003066	7.8788	0.003076
5.6061	0.003088	6.7576	0.003067	7.9091	0.003076
5.6364	0.003083	6.7879	0.003067	7.9394	0.003077
5.6667	0.003079	6.8182	0.003067	7.9697	0.003077
5.697	0.003075	6.8485	0.003068	8	0.003077
5.7273	0.003072	6.8788	0.003068		
5.7576	0.00307	6.9091	0.003068		
5.7879	0.003068	6.9394	0.003069		
5.8182	0.003066	6.9697	0.003069		
5.8485	0.003065	7	0.003069		
5.8788	0.003064	7.0303	0.003069		
5.9091	0.003063	7.0606	0.00307		
5.9394	0.003062	7.0909	0.00307		
5.9697	0.003062	7.1212	0.00307		