INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR

MA 202: MATHEMATICS - IV
Semester–II, Academic Year 2022-23

Tutorial Set -3
Question - 10

By

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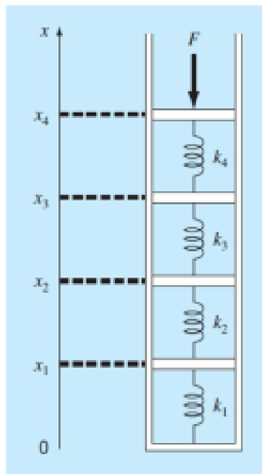
- In question 10, we are asked to estimate the value of x's. We are given the spring mass system. I have used the Gauss-Seidel method to compute the values of x. At equilibrium, force-balance equations can be developed defining the interrelationships between the springs. We have given these interrelationships as four equations.

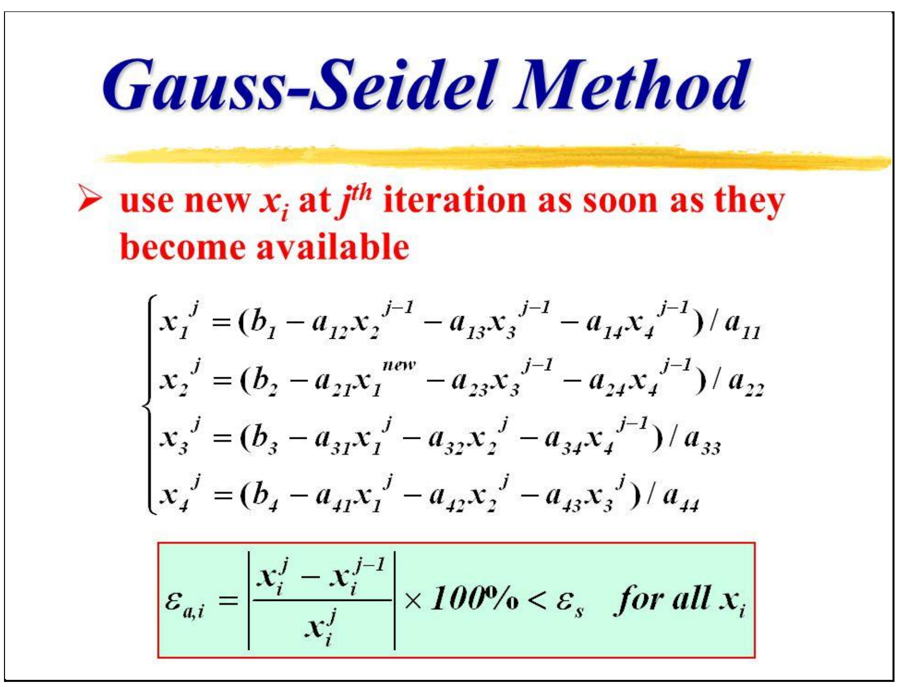
- We have made a coefficient matrix using all equations and then we can use it in the Gauss-Seidel method.

$$k_2(x_2 - x_1) = kx_1,$$
$$k_3(x_3 - x_2) = k_2(x_2 - x_1),$$
$$k_4(x_4 - x_3) = k_3(x_3 - x_2),$$
$$F = k_4(x_4 - x_3),$$

where the k's are spring constants. If k_1 through k_4 are 100, 50, 80, and 200 N/m, respectively, compute the x's.



➔ Gauss-Seidel method of power flow problem is an iterative method used to solve a system of linear equations. In this method we are using simple algebraic equations so that the calculation time for each iteration is less.



➔ I took the coefficient matrix A and B as an input and applied the above iterations on it to compute the solutions of the equations.

```
% Gauss Seidel Iteration method
% Call the function by giving two matrix as a input
function Xr = T10_20110131(A,B)
% Matrix A(n*n)
% Matrix B(n*1)              % System Ax=B
n = size(B);                 % Calculating the size of matrix B
p = n(1);                    % Define a number of rows in matrix B
tol = 0.0001;                % define a value of tolerance
Err = ones(p,1);             % Define a error column matrix
X  = zeros(p,1);             % Define a initial guess of solution
C  = zeros(p,1);             % Define a dummy column matrix for calculations
% Run a loop to find  final result by applying the condition of Gauss
% Seidel ietration method
while max(Err) > tol
    for i = 1:p
        C(i,1) = X(i,1);
        X(i,1) = (1/A(i,i)) * (B(i,1) - sum(A(i,:) * X(:,1)) + A(i,i)*X(i,1))
        Err(i,1) = abs(C(i,1) - X(i,1));
        C(i,1) = X(i,1);
    end
end
disp('Solution by Gauss Seidel Iteration Method is:')
Xr = X;
end
```

Code of Gauss Seidel method

```
>> Xr = T10_20110131([3 -1 0 0;5 -13 8 0;0 2 -7 5;0 0 -1 1],[0;0;0;10])
Solution by Gauss Seidel Iteration Method is:

Xr =

  19.999700343855558
  59.999174182212322
  84.998939288621571
  94.998939288621571

>>
```

Final Simulated output