

```
n = 3;
X = -4 * eye(n) + diag(ones(n - 1, 1), -1) + diag(ones(n - 1, 1), 1)
```

```
X = 3x3
    -4     1     0
     1    -4     1
     0     1    -4
```

```
I = eye(n);
O = zeros(n, n);
[X I O; I X I; O I X]
```

```
ans = 9x9
    -4     1     0     1     0     0     0     0     0
     1    -4     1     0     1     0     0     0     0
     0     1    -4     0     0     1     0     0     0
     1     0     0    -4     1     0     1     0     0
     0     1     0     1    -4     1     0     1     0
     0     0     1     0     1    -4     0     0     1
     0     0     0     1     0     0    -4     1     0
     0     0     0     0     1     0     1    -4     1
     0     0     0     0     0     1     0     1    -4
```

```
n = 200;
N = n * n;
e = ones(N, 1);

sub_diag = e;
super_diag = e;

sub_diag(n:n:N) = 0;
super_diag(1:n:N) = 0;

A = spdiags([e, sub_diag, -4 * e, super_diag, e], [-n, -1, 0, 1, n], N, N);
cond_A = condest(A)
```

```
cond_A = 2.3810e+04
```

```
b = A * ones(N, 1);
x = ones(N, 1);
```

```
nitmax = 1e4;
err = 1e-10;
```

```
[xj, ni] = jacobi(A, b, zeros(N, 1), err, nitmax)
```

Warning: Max iterations reached

```
xj = 40000x1
    0.9999
    0.9998
    0.9996
    0.9995
    0.9994
    0.9993
```

```

0.9992
0.9991
0.9989
0.9988
⋮
ni = 10000

```

```
rel_errorj = norm(xj - x) / norm(x)
```

```
rel_errorj = 0.2401
```

```
rel_errorj < cond_A * err
```

```
ans = logical
0
```

```
[xgs, ni] = gauss_seidel(A, b, zeros(N, 1), err, nitmax)
```

Warning: Max iterations reached

```

xgs = 40000x1
1.0000
0.9999
0.9999
0.9999
0.9998
0.9998
0.9998
0.9997
0.9997
0.9996
⋮
ni = 10000

```

```
rel_errorgs = norm(xgs - x) / norm(x)
```

```
rel_errorgs = 0.0708
```

```
rel_errorgs < cond_A * err
```

```
ans = logical
0
```

```
omega = relopt(A) % 1.9692
```

Warning: 3 of the 4 requested eigenvalues converged. Eigenvalues that did not converge are NaN.
omega = 1.9692

```
[xs, ni] = sor(A, b, omega, zeros(N, 1), err, nitmax)
```

```

xs = 40000x1
1.0000
1.0000
1.0000
1.0000

```

```

1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
1.0000
.
.
.
ni = 810

```

```
rel_errorsor = norm(xs - x) / norm(x)
```

```
rel_errorsor = 1.0564e-09
```

```
rel_errorsor < cond_A * err
```

```
ans = logical
      1
```

Dintre cele 3 metode, pentru eroarea dorita de $1e-10$, doar SOR reuseste sa converga in mai putin de 10,000 de iteratii, si converge chiar foarte bine.