```
%Cholesky for sparse matrices
close all;
clear all;

fprintf('No.3(a)\n\n');
%Load the matrix
load bcsstk38;
A = Problem.A;

fprintf('Make a spy plot of the matrix A showing its sparsity pattern \n\n');
figure(1)
spy(A)
title('Sparsity pattern of A');
ylabel('n');xlabel('n');

fprintf('Compute the sparsity ratio of A\n\n');

sparsity_ratio = 1 - nnz(A)/numel(A);

fprintf('The sparsity ratio is %f \n\n',sparsity_ratio);

fprintf('No.3(b)\n\n');
%Compute the Cholesky decomposition of the matrix from part (a)
R = chol(A);

%Plot the sparsity pattern of the upper triangular matrix,R, from the decomposition.
figure(2)
spy(R)
title('Sparsity pattern of the cholesky decomposition of A');
ylabel('n');xlabel('n');

%Compute the amount of “fill-in” from the Cholesky decomposition.
fillin = nnz(R)/nnz(A);
fprintf('The fill-in is %f \n\n',fillin);

fprintf('No.3(c)\n\n');
s = symrcm(A); S=A(s,s);
R2 = chol(S);
fillin2 = nnz(R2)/nnz(S);
fprintf('The fill-in of the permuted A is %f \n\n',fillin2);

fprintf('The fill-in for the permuted matrix is small than that for the original A.\n\n')

figure(3)
spy(S)
title('Sparsity pattern of the Permuted A');
ylabel('n');xlabel('n');

figure(4)
spy(R2)
title('Sparsity pattern of Cholesky decomposition of the Permuted matrix A');
ylabel('n');xlabel('n');
```

```
No.3(a)

Make a spy plot of the matrix A showing its sparsity pattern
```

Compute the sparsity ratio of A

The sparsity ratio is 0.994490

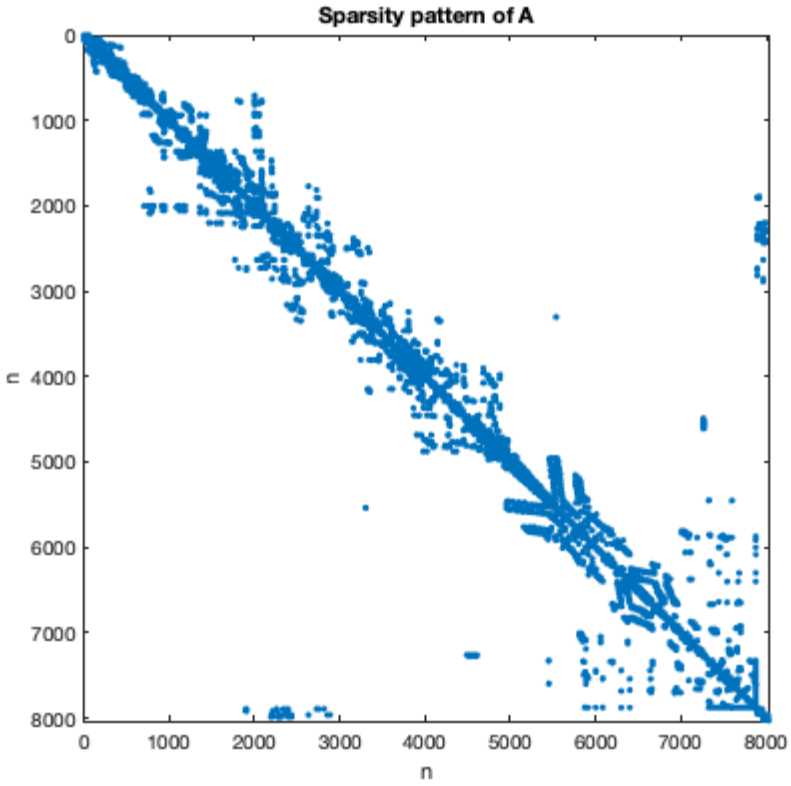
No.3(b)

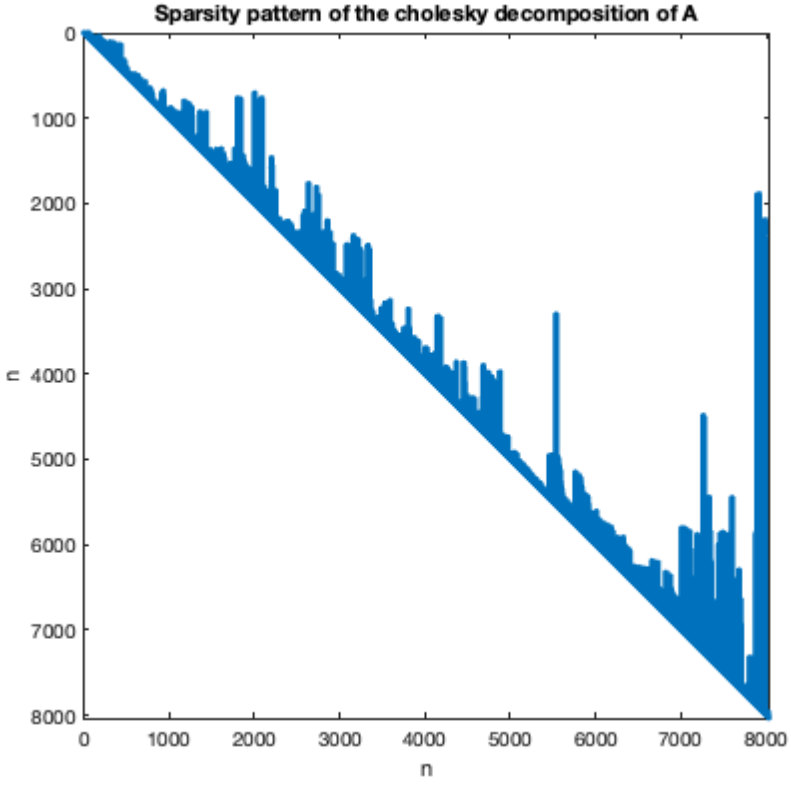
The fill-in is 4.738485

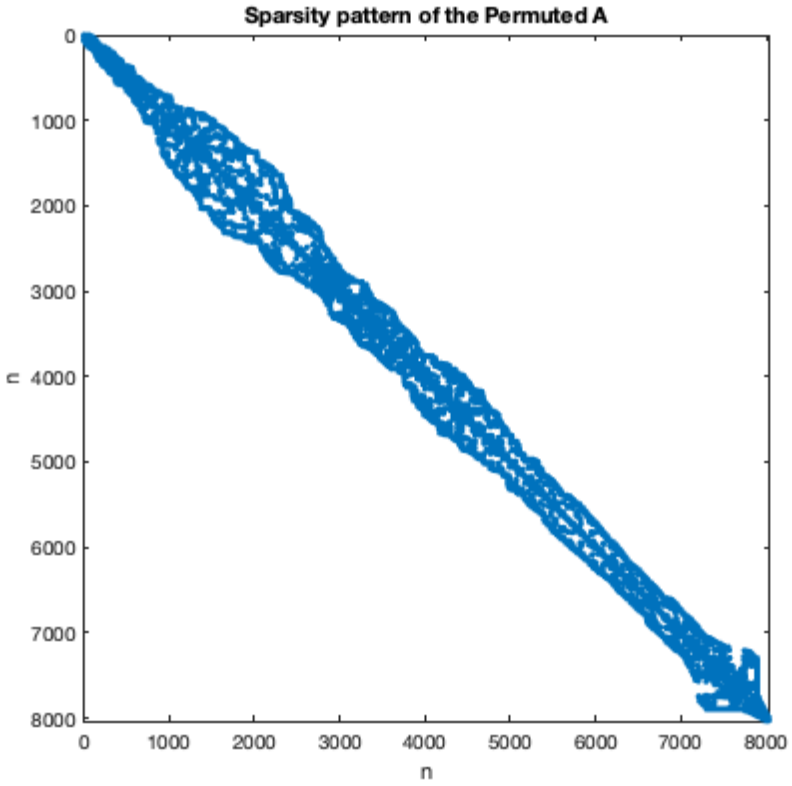
No.3(c)

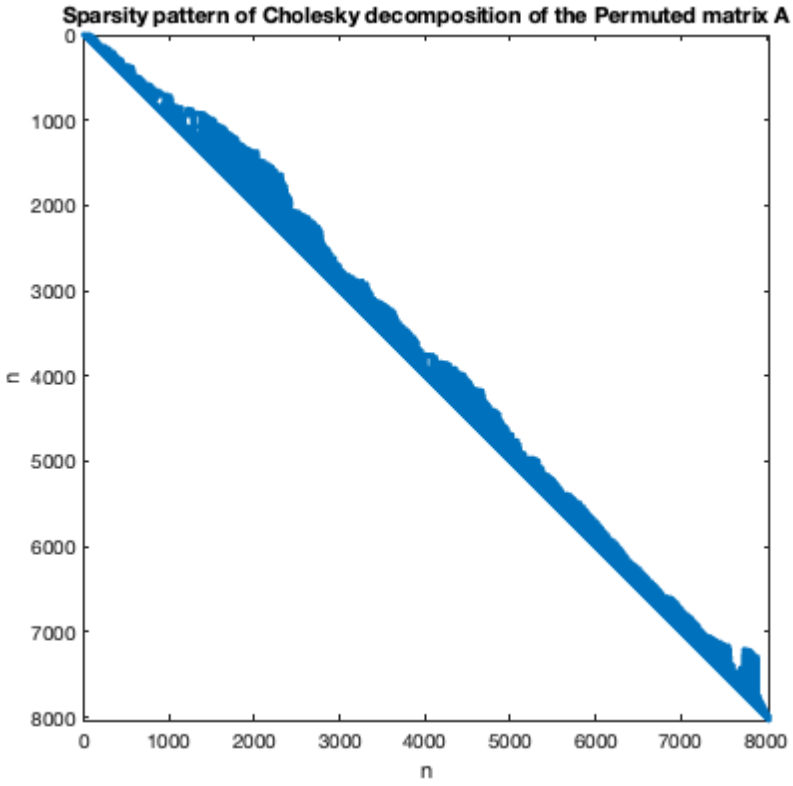
The fill-in of the permuted A is 4.038452

The fill-in for the permuted matrix is small than that for the original A.


Sparsity pattern of A
0
1000
2000
3000
4000
5000
6000
7000
8000
n
0
1000
2000
3000
4000
5000
6000
7000
8000
n


Sparsity pattern of the cholesky decomposition of A
0
1000
2000
3000
4000
5000
6000
7000
8000
n
0
1000
2000
3000
4000
5000
6000
7000
8000
n





Published with MATLAB® R2020b