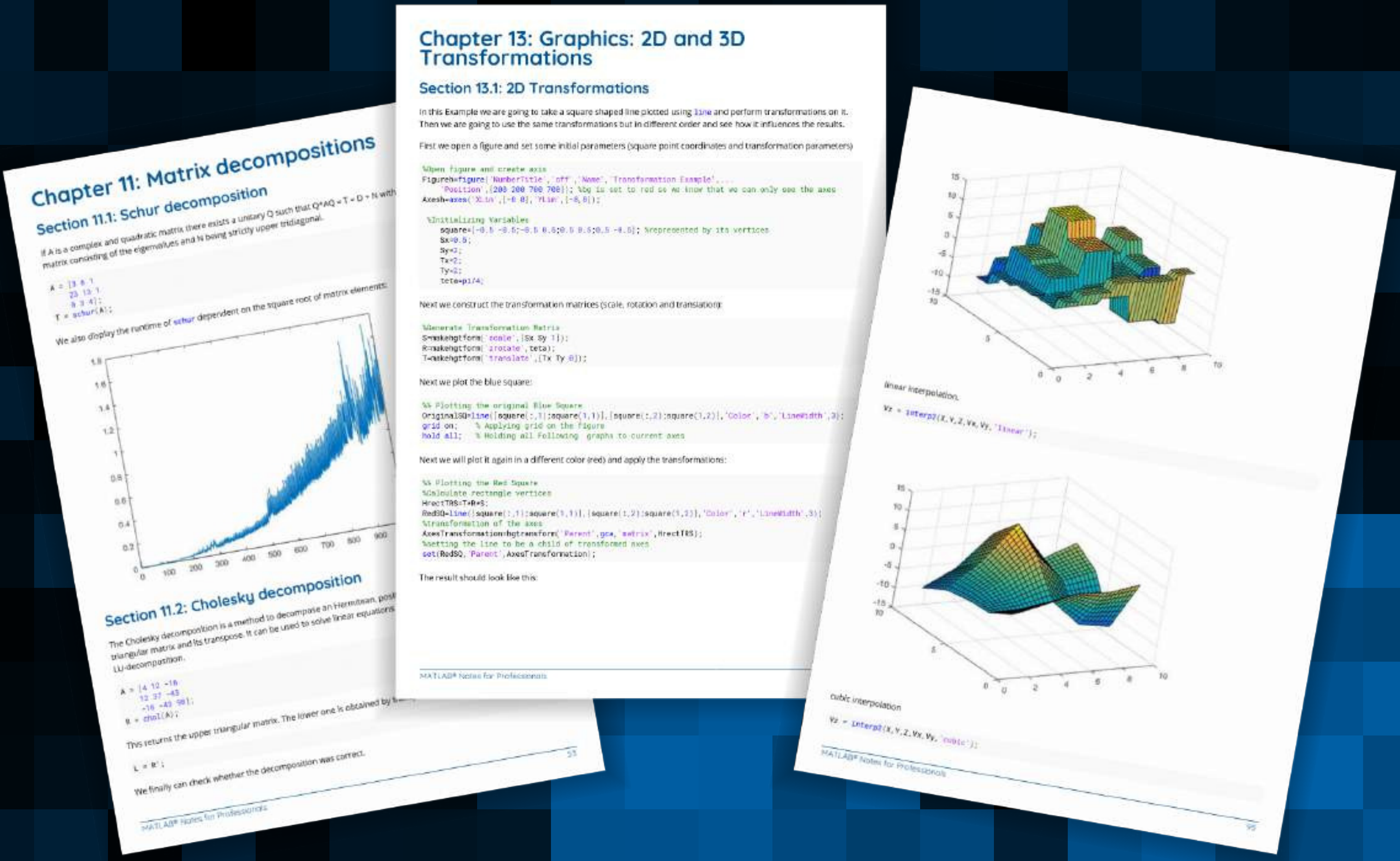
# MATLAB®

## Notes for Professionals



## Chapter 11: Matrix decompositions

### Section 11.1: Schur decomposition

If A is a complex and quadratic matrix there exists a unitary Q such that Q*AQ = T = D + N with
matrix consisting of the eigenvalues and N being strictly upper tridiagonal.

```
A = [3 6 1
     23 13 1
     8 3 4];
T = schur(A);
```

We also display the runtime of schur dependent on the square root of matrix elements:

### Section 11.2: Cholesky decomposition

The Cholesky decomposition is a method to decompose an Hermitean, posi
triangular matrix and its transpose. It can be used to solve linear equations
LU-decomposition.

```
A = [4 12 -16
     12 37 -43
     -16 -43 98];
R = chol(A);
```

This returns the upper triangular matrix. The lower one is obtained by tr

```
L = R';
```

We finally can check whether the decomposition was correct.

## Chapter 13: Graphics: 2D and 3D Transformations

### Section 13.1: 2D Transformations

In this Example we are going to take a square shaped line plotted using line and perform transformations on it. Then we are going to use the same transformations but in different order and see how it influences the results.

First we open a figure and set some initial parameters (square point coordinates and transformation parameters)

```
%Open figure and create axis
Figureh=figure('NumberTitle','off','Name','Transformation Example',...
    'Position',[200 200 700 700]); %bg is set to red so we know that we can only see the axes
Axesh=axes('XLim',[-8 8],'YLim',[-8,8]);

 %Initializing Variables
    square=[-0.5 -0.5;-0.5 0.5;0.5 0.5;0.5 -0.5]; %represented by its vertices
    Sx=0.5;
    Sy=2;
    Tx=2;
    Ty=2;
    teta=pi/4;
```

Next we construct the transformation matrices (scale, rotation and translation):

```
%Generate Transformation Matrix
S=makehgtform('scale',[Sx Sy 1]);
R=makehgtform('zrotate',teta);
T=makehgtform('translate',[Tx Ty 0]);
```

Next we plot the blue square:

```
%% Plotting the original Blue Square
OriginalSQ=line([square(:,1);square(1,1)],[square(:,2);square(1,2)],'Color','b','LineWidth',3);
grid on;    % Applying grid on the figure
hold all;   % Holding all Following  graphs to current axes
```

Next we will plot it again in a different color (red) and apply the transformations:

```
%% Plotting the Red Square
%Calculate rectangle vertices
HrectTRS=T*R*S;
RedSQ=line([square(:,1);square(1,1)],[square(:,2);square(1,2)],'Color','r','LineWidth',3);
%transformation of the axes
AxesTransformation=hgtransform('Parent',gca,'matrix',HrectTRS);
%seting the line to be a child of transformed axes
set(RedSQ,'Parent',AxesTransformation);
```

The result should look like this:

linear interpolation.

```
Vz = interp2(X,Y,Z,Vx,Vy,'linear');
```

cubic interpolation

```
Vz = interp2(X,Y,Z,Vx,Vy,'cubic');
```

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