**Noise Assisted Image Encryption and Decryption using 2-D Chaotic System**

CODES

**Figure 2. Bifurcation diagram of parameter c=0.8 for the system**

cmin=0.8;

cmax=1.2;

a=2.3;

b=0.4;

x0=1;

y0=0;

n=1000;

jmax=1000;

t=zeros(jmax+1,1);

z=zeros(jmax+1,100);

del=(cmax-cmin)/jmax;

for j=1:jmax+1

x=zeros(n+1,1);

y=zeros(n+1,1);

y(1)=y0;

x(1)=x0;

t(j)=(j-1)\*del+cmin;

c=t(j);

for i=1:n

x(i+1)=a\*x(i)-y(i)\*x(i);

y(i+1)=b\*x(i)-c\*y(i);

if (i>400)

z(j,i-400)=x(i+1);

end

end

end

subplot (1,1,1); plot(t,z,'.','MarkerSize',2,'color','blue')

xlabel('c','FontSize',10), ylabel('x','FontSize',10)

title('Bifurcation diagram for the new Chaotic Map')

**Figure 4. Time domain plot of noise signal**

t = 0:pi/100:50;

x =1\*randn(size(t));

plot(t,x)

xlabel('Time(ms)'), ylabel('Amplitude')

title('Time domain plot of noise signal')

**Figure 5. The Lyapunov exponent of the system**

figure (2)

clf

cmark=zeros(1,4800);

lyappmark=zeros(1,4800);

a= 2.3;

b= 0.4;

for i = 1:4800;

c = i / 3200 -1;

cmark(i)=c;

c=a-b;

d0 = 0.01;

x1 = 0;

y1 = 0;

x2 = 0;

y2 = d0;

lsum = 0;

for j = 1:32100

x1new = a \* x1 - x1 \* y1 ;

y1 = x1;

x1 = x1new;

x2new = b \* x1 - c \* y2;

y2 = x2;

x2 = x2new;

d1 = sqrt((x2 - x1) ^ 2 + (y2 - y1) ^ 2);

x2 = x1 + (d0 / d1) \* (x2 - x1);

y2 = y1 + (d0 / d1) \* (y2 - y1);

if j > 100

lsum = lsum + log2(d1 / d0);

end

end

le = lsum / (j - 101);

lyappmark(i)=le;

end

subplot (1,1,1); plot(bmark,lyappmark,'.','MarkerSize',4,'color','blue');

xlabel('c','FontSize',10), ylabel('x','FontSize',10)

title('Lyapunov Exponents for the new Chaotic System')

axis([-0.5 0.5 1 -2])

hold on

# **SIMULATION RESULTS**

function varargout = final(varargin)

gui\_Singleton = 1;

gui\_State = struct('gui\_Name', mfilename, ...

'gui\_Singleton', gui\_Singleton, ...

'gui\_OpeningFcn', @final\_OpeningFcn, ...

'gui\_OutputFcn', @final\_OutputFcn, ...

'gui\_LayoutFcn', [] , ...

'gui\_Callback', []);

if nargin && ischar(varargin{1})

gui\_State.gui\_Callback = str2func(varargin{1});

end

if nargout

[varargout{1:nargout}] = gui\_mainfcn(gui\_State, varargin{:});

else

gui\_mainfcn(gui\_State, varargin{:});

end

function final\_OpeningFcn(hObject, eventdata, handles, varargin)

handles.output = hObject;

ss=ones(300,300);

axes(handles.axes1);

imshow(ss);

axes(handles.axes2);

imshow(ss);

axes(handles.axes3);

imshow(ss);

axes(handles.axes4);

imshow(ss);

axes(handles.axes5);

imshow(ss);

axes(handles.axes6);

imshow(ss);

guidata(hObject, handles);

function varargout = final\_OutputFcn(hObject, eventdata, handles)

varargout{1} = handles.output;

function pushbutton1\_Callback(hObject, eventdata, handles)

a = get(handles.edit2,'string'); % Any Integer Value

meth='SHA-256';

h = hash(a,meth); % Hash Value Generation for H using SHA-256

set(handles.edit3,'string',h);

handles.h=h;

guidata(hObject, handles);

function radiobutton6\_Callback(hObject, eventdata, handles)

NS = wgn(1000,1,-6,'complex');

NS1= var(NS);

set(handles.edit4,'string',NS1);

handles.NS1=NS1;

guidata(hObject, handles);

function radiobutton2\_Callback(hObject, eventdata, handles)

h=handles.h;

NS1=handles.NS1;

H1=h(1:14);

H2=h(15:28);

H3=h(29:42);

xo=NS1.\*(mod(hex2dec(H1),512)); %% 512 size used based on plain image size

set(handles.edit6,'string',xo);

yo=NS1.\*(mod(hex2dec(H2),512));

set(handles.edit7,'string',yo);

zo=40+(NS1.\*(mod(hex2dec(H3),512)));

set(handles.edit8,'string',zo);

handles.xo=xo;

handles.yo=yo;

handles.zo=zo;

guidata(hObject, handles);

function radiobutton3\_Callback(hObject, eventdata, handles)

c=0.8;

set(handles.edit9,'string',c);

d=4;

set(handles.edit13,'string',d);

a=2.3;

set(handles.edit14,'string',a);

b=0.4;

set(handles.edit15,'string',b);

handles.c=c;

handles.a=a;

handles.b=b;

handles.d=d;

guidata(hObject, handles);

function radiobutton4\_Callback(hObject, eventdata, handles)

h=handles.h;

NS1=handles.NS1;

H5=h(57:64);

n1=(NS1.\*(mod(hex2dec(H5),512)))\*10000;

no=500+(mod(n1,1000));

set(handles.edit10,'string',no);

handles.no=no;

guidata(hObject, handles);

function radiobutton5\_Callback(hObject, eventdata, handles)

xo=handles.xo;

yo=handles.yo;

zo=handles.zo;

c=handles.c;

a=handles.a;

b=handles.b;

d=handles.d;

no=handles.no;

h=0.008911; %% It is given in base paper

%% Chotic State

XX=(a.\*xo)-(xo.\*yo)/100;

YY=(b.\*xo)-(c.\*yo)/100;

t3=(c.\*zo)+(d.\*xo^2);

ZZ=(zo+(h\*t3))/100;

X1=randi([0 255],512,512); %% 512\*512 size used based on plain image size

X=XX+X1;

axes(handles.axes1);

imshow(uint8(X));

title('Sequence X');

Y=YY+X1;

axes(handles.axes2);

imshow(uint8(Y));

title('Sequence Y');

Z=ZZ+X1;

axes(handles.axes3);

imshow(uint8(X));

title('Sequence Z');

save('initialvalues.mat','xo','yo','zo','c','no','X1');

handles.X=X;

handles.Y=Y;

handles.Z=Z;

guidata(hObject, handles);

function radiobutton1\_Callback(hObject, eventdata, handles)

X=handles.X;

Y=handles.Y;

Z=handles.Z;

\_alpha = 0.95; % signal gain

Xr=alpha\*X;

axes(handles.axes4);

imshow(uint8(Xr));

title('Sequence Xr');

Yg=alpha\*Y;

axes(handles.axes5);

imshow(uint8(Yg));

title('Sequence Yg');

Zb=alpha\*Z;

axes(handles.axes6);

imshow(uint8(Zb));

title('Sequence Zb');

save('TS.mat','Xr','Yg','Zb');

% Update handles structure

guidata(hObject, handles);

function edit2\_Callback(hObject, eventdata, handles)

% hObject handle to edit2 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit2 as text

% str2double(get(hObject,'String')) returns contents of edit2 as a double

% --- Executes during object creation, after setting all properties.

function edit2\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit2 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit3\_Callback(hObject, eventdata, handles)

% hObject handle to edit3 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit3 as text

% str2double(get(hObject,'String')) returns contents of edit3 as a double

% --- Executes during object creation, after setting all properties.

function edit3\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit3 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit4\_Callback(hObject, eventdata, handles)

% hObject handle to edit4 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit4 as text

% str2double(get(hObject,'String')) returns contents of edit4 as a double

% --- Executes during object creation, after setting all properties.

function edit4\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit4 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit5\_Callback(hObject, eventdata, handles)

% hObject handle to edit5 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit5 as text

% str2double(get(hObject,'String')) returns contents of edit5 as a double

% --- Executes during object creation, after setting all properties.

function edit5\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit5 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit6\_Callback(hObject, eventdata, handles)

% hObject handle to edit6 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit6 as text

% str2double(get(hObject,'String')) returns contents of edit6 as a double

% --- Executes during object creation, after setting all properties.

function edit6\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit6 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit7\_Callback(hObject, eventdata, handles)

% hObject handle to edit7 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit7 as text

% str2double(get(hObject,'String')) returns contents of edit7 as a double

% --- Executes during object creation, after setting all properties.

function edit7\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit7 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit8\_Callback(hObject, eventdata, handles)

% hObject handle to edit8 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit8 as text

% str2double(get(hObject,'String')) returns contents of edit8 as a double

% --- Executes during object creation, after setting all properties.

function edit8\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit8 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit9\_Callback(hObject, eventdata, handles)

% hObject handle to edit9 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit9 as text

% str2double(get(hObject,'String')) returns contents of edit9 as a double

% --- Executes during object creation, after setting all properties.

function edit9\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit9 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit10\_Callback(hObject, eventdata, handles)

% hObject handle to edit10 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit10 as text

% str2double(get(hObject,'String')) returns contents of edit10 as a double

% --- Executes during object creation, after setting all properties.

function edit10\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit10 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit11\_Callback(hObject, eventdata, handles)

% hObject handle to edit11 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit11 as text

% str2double(get(hObject,'String')) returns contents of edit11 as a double

% --- Executes during object creation, after setting all properties.

function edit11\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit11 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit12\_Callback(hObject, eventdata, handles)

% hObject handle to edit12 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit12 as text

% str2double(get(hObject,'String')) returns contents of edit12 as a double

% --- Executes during object creation, after setting all properties.

function edit12\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit12 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

% --- Executes on button press in radiobutton7.

function radiobutton7\_Callback(hObject, eventdata, handles)

% hObject handle to radiobutton7 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hint: get(hObject,'Value') returns toggle state of radiobutton7

final1

% --- Executes during object creation, after setting all properties.

function figure1\_CreateFcn(hObject, eventdata, handles)

% hObject handle to figure1 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

function edit13\_Callback(hObject, eventdata, handles)

% hObject handle to edit13 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit13 as text

% str2double(get(hObject,'String')) returns contents of edit13 as a double

% --- Executes during object creation, after setting all properties.

function edit13\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit13 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit14\_Callback(hObject, eventdata, handles)

% hObject handle to edit14 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit14 as text

% str2double(get(hObject,'String')) returns contents of edit14 as a double

% --- Executes during object creation, after setting all properties.

function edit14\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit14 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

function edit15\_Callback(hObject, eventdata, handles)

% hObject handle to edit15 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles structure with handles and user data (see GUIDATA)

% Hints: get(hObject,'String') returns contents of edit15 as text

% str2double(get(hObject,'String')) returns contents of edit15 as a double

% --- Executes during object creation, after setting all properties.

function edit15\_CreateFcn(hObject, eventdata, handles)

% hObject handle to edit15 (see GCBO)

% eventdata reserved - to be defined in a future version of MATLAB

% handles empty - handles not created until after all CreateFcns called

% Hint: edit controls usually have a white background on Windows.

% See ISPC and COMPUTER.

if ispc && isequal(get(hObject,'BackgroundColor'), get(0,'defaultUicontrolBackgroundColor'))

set(hObject,'BackgroundColor','white');

end

**Run final code given avove.**

**Type any integer number in External Key box..**

**Then Click hash Code button**

**After complete the key generation process...**

**Click Plain Image button, then select the any one image plain image.**

**After click next next button for continuous process**