This tutorial walks you through every change needed to adapt the MATLAB GUI script for your specific bifurcation curves and naming conventions. You'll find clear "original vs. updated" code snippets for:

- Renaming the main figure and labels
- Adjusting slider limits based on your `.mat` data
- Updating descriptions, titles, and saved filenames
- Modifying point definitions and 3D plot labels
- Customizing video-simulation colors and styles

A video tutorial is available as well here

https://drive.google.com/file/d/1OlQ_NxlpPuwdRULWCRdsLamT2rcQdWJh/view?usp=sharing

---

1. Change the figure name (line 13)

Original:

```
fig = uifigure('Position', [20, 50, 1300, 750], 'Name', 'SNIC/SH', 'Color', [1 1 1]);
```

Updated:

```
fig = uifigure('Position', [20, 50, 1300, 750], 'Name', 'Name/Name', 'Color', [1 1 1]);
```

---

2. Update the onset-curve label (line 21)

Original:

```
uilabel(fig, 'Position', [50,Height, 400, 22], 'Text', 'Onset curve index: SNIC', 'FontSize', fontsize, 'FontWeight', 'bold');
```

Updated:

```
uilabel(fig, 'Position', [50,Height, 400, 22], 'Text', 'Onset curve index: New Onset', 'FontSize', fontsize, 'FontWeight', 'bold');
```

3. Update the onset description (line 23)

Original:

```
descriptionLines = {
  '';
  'Crossing the SNIC curve will result in onset of a signal with increasing frequency and fixed amplitude. ';
};
```

Updated:

```
descriptionLines = {
  '';
  'New onset bifurcation description';
};
```

4. Change A-slider limits (line 76)

Original:

```
ASlider = uislider(fig, 'Position', [50,Height, 500, 3], 'Limits', [1, 44], 'Value', 1);
```

Updated:

```
ASlider = uislider(fig, 'Position', [50,Height, 500, 3], 'Limits', [1, NEW_A_LIMIT], 'Value', 1);
```

> *Replace `NEW_A_LIMIT` with the correct max index from your curves$_2$ `.mat` file.*

5. Update offset-curve label (line 77)

Original:

uilabel(fig, 'Position', [50,Height, 400, 22], 'Text', 'Offset curve index: SH', 'FontSize', fontsize, 'FontWeight', 'bold');

Updated:

uilabel(fig, 'Position', [50,Height, 400, 22], 'Text', 'Offset curve: New Offset', 'FontSize', fontsize, 'FontWeight', 'bold');

---

6. Update the offset description (line 81)

Original:

```
descriptionLines = {
  '';
  'Crossing the SH curve will result in a signal terminating with decreasing frequency and DC shift. ';
};
```

Updated:

```
descriptionLines = {
  '';
  'New offset bifurcation description';
};
```

---

7. Change B-slider limits (line 132)

Original:

BSlider = uislider(fig, 'Position', [50,Height, 500, 3], 'Limits', [1, 54], 'Value', 1);

Updated:

BSlider = uislider(fig, 'Position', [50,Height, 500, 3], 'Limits', [1, NEW_B_LIMIT], 'Value', 1);

> *Replace `NEW_B_LIMIT` with the correct max index.*

---

8. Change the GUI title (line 491)

Original:

titleLabel = uilabel(fig, 'Position', [830, 700, 500, 40], 'Text', 'SNIC/SH - Parameter Control and Visualization', 'FontSize', 16, 'FontWeight', 'bold');

Updated:

titleLabel = uilabel(fig, 'Position', [830, 700, 500, 40], 'Text', 'Name/Name - Parameter Control and Visualization', 'FontSize', 16, 'FontWeight', 'bold');

---

9. Update the main description (line 493)

Original:

```
descriptionLines = {
  'SNIC/SH seizures have a saddle node invariant cycle (SNIC) onset and a saddle homoclinic (SH) offset. In the x time series, the SNIC onset creates a square root scaling of the frequency and the SH offset creates a logarithmic scaling of the frequency. At seizure onset, no DC shift occurs and the spiking rate increases in frequency. At seizure offset, there is a DC shift and the spiking rate decreases in frequency. '
};
```

Updated:

```
descriptionLines = {
  'New Description';
};
```

a. Each GUI has a description of the dynamotype under the variable descriptionLines that can be edited.
   i. Here are the descriptions of each class:
      1. SN/SH (+DC): Class SN/SH seizures have a saddle node (SN) onset bifurcation and a saddle homoclinic (SH) offset bifurcation. In the x time series, this appears as a DC shift that begins when the seizure starts and ends when the seizure stops. Spikes also slow, logarithmically, in frequency at seizure offset. Class SN/SH

seizures are found in the Epileptor, which only revealed the most dominant dynamotype: SN/SH;

2. SN/SH(-DC): Like SN/SH(DC+) seizures, Sn/SH(-DC) have a saddle node (SN) onset bifurcation and a saddle homoclinic (SH) offset. However, SN/SH(-DC) seizures are located in the lower region of the state-space diagram. In the lower region, the stable fixed point lies within the limit cycle, so there is no baseline shift in the x1 time series that is analogous to a DC shift during the seizure. At seizure offset, the spiking rate slows, logarithmically in frequency.
3. SN/SupH: SN/SupH seizures have a saddle node (SN) onset bifurcation and a supercritical Hopf (SupH) offset bifurcation. In the x time series, there is a DC shift at seizure onset and decreasing amplitude at seizure offset.
4. SN/SupH(example 2): SN/SupH seizures have a saddle node (SN) onset bifurcation and a supercritical Hopf (SupH) offset bifurcation. In the x time series, there is a DC shift at seizure onset and decreasing amplitude at seizure offset. Similar to the SN/SH, bursting does not begin until a second bifurcation crossing at the SupH bifurcation, but since the system first must cross the SN bifurcation to have a DC shift, our convention is that this will be classified as a SN onset.
5. SN/FLC: SN/FLC seizures have a saddle node (SN) onset bifurcation and a fold limit cycle (FLC) offset bifurcation. Like SN/SH seizures, the path is located in the lower region of the parameter space diagram, such that no DC shift occurs at seizure onset. The x time series does not exhibit any distinguishing features for the FLC offset (i.e., no amplitude scaling, no frequency scaling, no baseline shift). Therefore, these seizures have generally arbitrary onset and offset dynamics.
6. SubH/SH: SubH/SH seizures have a subcritical Hopf (SubH) onset bifurcation and a saddle homoclinic (SH) offset bifurcation. A SubH onset bifurcation has arbitrary dynamics, with no specific scaling rule for amplitude or frequency. Since the path is located in the lower region of the parameter space diagram, no DC shift occurs at seizure offset, but the spikes exhibit frequency slowing logarithmically.
7. SubH/FLC: SubH/FLC seizures have a Subcritical Hopf (SubH) onset bifurcation and a fold limit cycle (FLC) offset bifurcation. Neither of these bifurcations have any distinguishing features in the x time series (i.e., no amplitude scaling, no frequency scaling, no baseline shift). In other words, SubH/FLC seizures have generally arbitrary onset and offset dynamics.

8. SN/SNIC: SN/SNIC seizures have a saddle node (SN) onset and a saddle node invariant cycle (SNIC) offset. These seizures lie in the upper region of the parameter space diagram. As a result, the stable fixed point lies to the right of the limit cycle, such that entering the limit cycle causes a baseline shift in the x time series. This baseline shift is analogous to a DC shift at seizure onset. At offset, SNIC creates a logarithmic scaling of the frequency, with the spiking rate decreasing in frequency.
9. SN/SNIC: SN/SNIC seizures have a saddle node (SN) onset and a saddle node invariant cycle (SNIC) offset.This is similar to SN/SH example 2 in the hysteresis bursters, where by convention we label the seizure by the DC shift at SN bifurcation, rather than the subsequent SupH bifurcation. Therefore, there is first a DC shift at onset. At seizure offset the saddle node invariant cycle (SNIC) onset creates a square root scaling of decreasing frequency. There is no DC shift at offset.
10. SNIC/SNIC: SNIC/SNIC seizures have a saddle node invariant cycle onset (SNIC) and a saddle node invariant cycle (SNIC) offset. In the x time series, the SNIC bifurcation for both onset and offset creates a square root scaling of the frequency. The spikes exhibit frequency increasing at onset and decreasing at offset. There is no DC shift occurring at onset or offset.
11. SNIC/SH: SNIC/SH seizures have a saddle node invariant cycle (SNIC) onset and a saddle homoclinic (SH) offset. In the x time series, the SNIC onset creates a square root scaling of the frequency and the SH offset creates a logarithmic scaling of the frequency. At seizure onset, no DC shift occurs and the spiking rate increases in frequency. At seizure offset, there is a DC shift and the spiking rate decreases in frequency.
12. SNIC/SupH: SNIC/SupH seizures have a saddle node invariant cycle (SNIC) onset and a supercritical Hopf (SupH) offset. At seizure onset, in the x time series, the saddle node invariant cycle (SNIC) onset creates a square root scaling of increasing frequency. The SupH offset creates logarithmically decreasing amplitude. This trajectory induces a DC shift at seizure offset.
13. SNIC/FLC: SNIC/FLC seizures have a saddle node invariant cycle (SNIC) onset and a fold limit cycle (FLC) offset. In the x time series, the SNIC onset creates a square root scaling of the frequency. The spikes exhibit the frequency increasing during seizure onset. During seizure offset, the time series x does not exhibit any distinguishing features (i.e., no amplitude scaling, no frequency scaling, no baseline shift). There is no DC shift occurring at onset or offset.

14. SupH/FLC: SupH/FLC seizures have a supercritical Hopf (SupH) cycle onset and a fold limit cycle (FLC) offset. In the time series x, the amplitude increases during seizure onset. During seizure offset, the time series x does not exhibit any distinguishing features (i.e., no amplitude scaling, no frequency scaling, no baseline shift). There is no DC shift occurring at onset or offset.
15. SubH/SNIC: SubH/SNIC seizures have a Subcritical Hopf (SubH) onset and a saddle node invariant cycle (SNIC) offset. During seizure onset, the time series x does not exhibit any distinguishing features (no amplitude scaling, no frequency scaling, no baseline shift). Also, in the x time series, the SNIC offset creates a square root scaling of the frequency. The spikes exhibit the frequency slowing during seizure offset. There is no DC shift occurring at onset or offset.
16. subH/SupH: SubH/SupH seizures have a subcritical Hopf (SubH) onset and a supercritical Hopf (SupH) offset. During seizure onset, the time series x does not exhibit any distinguishing features(i.e., no amplitude scaling, no frequency scaling, no baseline shift). Also, in the time series x, the amplitude decreases during seizure offset. There is no DC shift occurring at onset or offset.
17. SN/SupH: SN/SupH seizures have a saddle node (SN) onset bifurcation and a supercritical Hopf (SupH) offset bifurcation. In the x time series, this appears as a DC shift that begins when the seizure starts and an amplitude decreasing to zero at the end of the seizure. Since the SupH offset curve is not adjacent to a rest region on the parameter space map, the bursting path does not return to the same baseline as at offset. As a result, there is a new baseline at seizure offset.
18. SNIC/SupH: SNIC/SupH seizures have a saddle node invariant cycle (SNIC) onset and a supercritical hopf (SupH) offset. At seizure onset, in the x time series, the saddle node invariant cycle (SNIC) onset creates a square root scaling of the frequency. The SH offset creates a logarithmic scaling of the frequency. There is no DC shift at onset. As in the previous SN/SupH piecewise example, the bursting path does not return to the same baseline at offset.
19. SupH/SNIC: SupH/SNIC seizure have a saddle node invariant cycle (SNIC) onset and a supercritical Hopf (SupH) offset. The SupH onset creates an increase in amplitude in the signal. At seizure offset, in the x time series, the saddle node invariant cycle (SNIC) onset creates a square root scaling of the frequency. There is no DC shift at onset, and there is a new baseline after seizure offset.

20. SupH/SH: SupH/SH seizures have a supercritical Hopf (SupH) onset bifurcation and a saddle homoclinic (SH) offset bifurcation. At seizure onset, in the x time series, there is an increase in amplitude. There is no DC shift at seizure onset. Also, the SH offset creates a logarithmic scaling of the frequency and there is a DC shift at seizure offset.
21. SupH/SupH: SupH/SupH seizures have a supercritical Hopf (SupH) onset bifurcation and a supercritical Hopf (SupH) offset bifurcation. At seizure onset, in the x time series, there is an increase of amplitude and an amplitude decreasing to zero at seizure offset. There is no DC shift occurring at onset or offset.

---

10. Save-fig filename (line 570)

Original:

```
savefig(fig, 'SNIC_SH_GUI.fig');
```

Updated (optional):

```
savefig(fig, 'SNIC_SH_GUI.fig');
```

> *Change filename if desired.*

---

11. Update point definitions in `runSimulation`, `runVideoSimulation`, `runppSimulation`

Original:

```
p2 = SNIC(:,floor(AIndex))';
p3 = [0.33, 0.11, 0.18];
p1 = SHl(:,floor(BIndex+50))';
```

Updated:

```
p2 = new_curve(:, floor(AIndex))';       % ← Replace new_curve
```

```
p3 = [X1, X2, X3];                    % ← Replace [X1, X2, X3]
p1 = new_curve(:, floor(BIndex))';    % ← Replace new_curve
```

---

12. Adjust 3D bifurcation plots

Replace hidden curves with `HandleVisibility','off'`, and label visible onset/offset curves with `DisplayName`.

Example Updated Onset/Offset:

```
plot3(ax2, SNIC_scaled(1,:), SNIC_scaled(2,:), SNIC_scaled(3,:), ...
   'LineStyle','--', ...
   'DisplayName','Onset and offset curve');
```

a. The piecewise GUI has a variable called index_array that gives each dynamotype that can be produced using piecewise bursting: index_array = [3,7,9,10,11];. Below index_array, there is a variable called bifurcation: bifurcation = index_array(5);. This index_array(5) means that you will select the 5th element in the array, which would produce the if bifurcation=11, which is the dynamotype that corresponds to the supH onset and supH offset. The if bifurcation code starting on line 2234 allows the code to choose which thing to follow based on what number you indexed into your index_array. P0 is a fixed resting point, p1 is a point on the onset bifurcation curve, p1_5 is a random point, p2 is a point on the offset bifurcation curve, and p3 is the return fixed point.

b. The slow wave GUI has 3 points that you can change to get different dynamotypes. The dynamotype that is already in the code is SNIC/SH.

   i. There are 3 places where you see the code: p2 = SNIC(:,floor(AIndex))';
      p3 = [0.33, 0.11, 0.18];
      p1 = SHl(:,floor(BIndex+50))';on lines 599–601, 868–870, and in order to get the dynamotypes that can be done using slow wave bursting, you need to change the SNIC/SHl to the corresponding bifurcation names to get the desired dynamotype.

      1. SNIC/SNIC: SNIC/SNIC: p2 = SNIC(:,floor(AIndex))'; p3 = [0.34, 0.14, 0.06]; p1 = SNIC(:,floor(BIndex+50))';
      2. SNIC/SH: p2 = SNIC(:,floor(AIndex))'; p3 = [0.33, 0.11, 0.18]; p1 = SHl(:,floor(BIndex+50))';
      3. SNIC/Hopf: p2 = SNIC(:,floor(AIndex))'; p3 = [0.36, -0.12, 0.12]; p1 = Hopf(:,floor(BIndex+50))';
      4. SNIC/FLC: p2 = SNIC(:,floor(AIndex))'; p3 = [0.34, 0.2, -0.06]; p1 = FLC(:,floor(BIndex+50))';

5. Hopf/SNIC: p2 = Hopf(:,floor(AIndex))'; p3 = [0.36, -0.12, 0.12]; p1 = SNIC(:,floor(BIndex+50))';
6. Hopf/FLC: p2 = Hopf(:,floor(AIndex))'; p3 = [-0.3, -0.2, -0.2]; p1 = FLC(:,floor(BIndex+50))';
7. FLC/SNIC: p2 = FLC(:,floor(AIndex))'; p3 = [0.34, 0.2, -0.06]; p1 = SNIC(:,floor(BIndex+50))';
8. FLC/Hopf: p2 = FLC(:,floor(AIndex))'; p3 = [-0.3, -0.2, -0.2]; p1 = Hopf(:,floor(BIndex+50))';

c. The hysteresis GUI has 2 points that you can change to get different dynamotypes:
    i. There are 3 places where you see the code A = SHl(:,floor(AIndex)); B = SNr_LCs(:,floor(BIndex)), and in order to get all of the dynamotypes that can be done using hysteresis bursting, you need to change the SNr_LCs/SHl to the corresponding bifurcation names to get the desired dynamotype:
    ii.
        1. SN/SH(lcb): B= SNr_LCb(:,floor(BIndex)); A= SHb(:,floor(AIndex));
        2. SN/FLC: B= SNr_LCb(:,floor(BIndex)); A= FLC_top(:,floor(AIndex));
        3. Hopf/SH: B= Hopf(:,floor(BIndex)); A= SHb(:,floor(AIndex));

---

13. Update scatter3 fixed-point markers

Original:

```
scatter3(ax2, p1(1)*scale, p1(2)*scale, p1(3)*scale, 100, 'MarkerFaceColor','k',
'DisplayName','Offset point','Marker','square');
```

Updated:

```
scatter3(ax2, p1(1)*scale, p1(2)*scale, p1(3)*scale, 100, 'MarkerFaceColor','k',
'DisplayName','New Label','Marker','square');
```

Repeat for `p2` and `p3`, updating `DisplayName` and `Marker`.

---

14. Update video-simulation line colors/styles

Original Onset:

plot(ax1, ..., 'Color',[0.957,0.612,0.204], 'LineStyle','--','HandleVisibility','off');

Updated Onset:

plot(ax1, ..., 'Color',[R1,G1,B1], 'LineStyle','x','HandleVisibility','off');

> *Replace `[R1,G1,B1]`, and repeat for offset.*

---

15. Change saved timeseries filename in `get_mat_file`

Original:

save('SNIC_SH_timeseries.mat', 'Time', 'Signal', 'param_text');

Updated:

save('new_name_timeseries.mat', 'Time', 'Signal', 'param_text');

> *Replace `new_name_timeseries.mat`.*

End of tutorial. Replace all UPPERCASE placeholders with your desired values.```