Numerical Experiments with Wes’s Program       June 11, 2007

These figures correspond to “Fixed period pacing, homogeneous loop” described in Hassan’s SITR website. Here, the APD restitution function is

\[ f(t) = a - be^{-\sigma t} + pe^{-\gamma(t-\tau)^2} + \frac{(new \ c)(t - new \ d)}{(t - new \ d)^2 + new \ k} - 8e^{-0.025(t-80)}. \]

DEFAULT PARAMETERS:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>a</th>
<th>b</th>
<th>(\sigma)</th>
<th>p</th>
<th>(\gamma)</th>
<th>(\tau)</th>
<th>new c</th>
<th>new d</th>
<th>new k</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>350</td>
<td>157</td>
<td>0.0021</td>
<td>-20</td>
<td>0.0004</td>
<td>136</td>
<td>1700</td>
<td>82</td>
<td>1200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantity</th>
<th>c</th>
<th>d</th>
<th>(\Delta L)</th>
<th>(\omega)</th>
<th>(\alpha)</th>
<th>s</th>
<th>(DI^*)</th>
<th>(DI^{**})</th>
<th>(B_n)</th>
<th>(\delta_2)</th>
<th>(\delta_1)</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>0.07</td>
<td>1.0</td>
<td>0.125</td>
<td>0.02</td>
<td>0.05</td>
<td>15.4176</td>
<td>171.699</td>
<td>400</td>
<td>120</td>
<td>16</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Above, \(\delta_2\) was the \(\delta\)-value associated with reentry and \(\delta_1\) was the \(\delta\)-value associated with UDC mode. Although \(\delta_1\) was set to 16, it will be convenient to let it equal \(DI^*\) in future simulations. Initial \(DI\) was 100 in all cells unless otherwise indicated.

Run 1.1: Default parameters. Two beats of reentry followed by steady UDC.

Run 1.2: \(B_n\) reduced to 380. Reentry terminated in beat 34, Cell 1 due to failure of T4.
Run 1.5: \( B_n = 340 \). Alternating pattern of 2 reentrant beats, 2 UDC beats.

Run 1.6: \( B_n = 320 \). (a) Beats 1 through 20. (b) Beats 21 through 40. (c) Beats 41 through 60. Reentry sustained from Beat 36 onward, and all DI values tend to 59.3845.
Run 1.7: $B_n = 310$. Reentry occasionally interrupted by UDC beats.

Run 1.8: $B_n = 300$. Eventual pattern of 9 reentrant beats, 2 UDC beats.

Run 1.9: $B_n = 290$. Strange pattern of several reentrant beats, UDC mode, and UDC mode conduction block.
In Runs 2.#, the parameter $d$ has been changed from default value of 1.0 to 1.1.

Run 2.1: $B_n = 370$. Reentry terminated in Beat 50, Cell 97 due to failure of T4.

Run 2.2: $B_n = 340$. Alternating pattern of two beats reentry, two beats UDC.

Run 2.3: $B_n = 310$. Pattern repeats approximately every 75 beats.
Run 2.4: $B_n = 300$.

Run 2.5: $B_n = 290$.

Run 2.6: $B_n = 280$. Reentry terminated in Beat 38. Seems to lead to a 2:1 UDC response (note the larger steady-state DI).
Run 2.7: \( B_n = 200 \). Sustained UDC after a brief initial transient.

In Runs 3.#, we again work from default parameters, but use initial DI of 60 in each cell

Run 3.1: \( B_n = 400 \). Reentry sustained, and all DI values tend to 59.3845.

Run 3.3: \( B_n = 280 \). Reentry terminates in Beat 36, Cell 1 due to failure of T4, leading to steady UDC.

The other Runs 3.# didn’t generate figures that were very interesting.