

# SITR Case-studies 1 and 2 supplements

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This file supplements Case-studies 1 and 2 in the Model Description on this web site (also see the main SITR paper). More simulations are added here. Consider a homogeneous loop with the APD and CT restitutions defined as in the Model Description. We also set the length  $L$  and other parameters as:

$\Delta L$	$DI^*$	$\delta$	$B_0$
0.1	15.3 ms	120 ms	320 ms

where  $B_0$  is the fixed cycle length of the pacer; it is chosen small in this case-study to facilitate re-initiations of reentry. The value of  $\delta$  is set high enough to inhibit pacer interference.

**Supplement 1:** The following table summarizes the results of simulations with  $m = 125$  or  $L = 12.5$  cm; it expands the Case-study 1 table in the Model Description.

$DI_{i,0}$ , $i = 1, \dots, 125$	SITR pattern mode sequence
300 ms	$\{-1, 2, -2, 2, -2, \dots\}$
220 and 210 ms	$\{-\infty\}$ (no reentry initiated)
200-110 ms (10 ms steps)	$\{-2, 2, -2, 2, \dots\}$
100 ms	$\{-2, 4, -2, 32[73], -2, \infty\}$
90 ms	$\{-2, 4, -2, 31[74], -2, \infty\}$
82 ms	$\{-1, 9, -2, 2, -2, 2, \dots\}$
80 ms	$\{-1, \infty\}$
75 ms	$\{2, -2, 2, -2, \dots\}$
70 ms	$\{4, -2, 14, -2, 4, -2, 22[49], -\infty\}$
65 ms	$\{-1, \infty\}$
60 and 55 ms	$\{\infty\}$
50 ms	$\{11, -2, 4, -2, 27[57], -2, \infty\}$
45 ms	$\{1, -\infty\}$
40 ms	$\{1, -2, 31[77], -2, \infty\}$
30 and 20 ms	$\{1, -2, \infty\}$
18 and 16 ms	$\{-\infty\}$ (no reentry initiated)

In Runs that lock into the reentry mode (end with  $\infty$ ) the DI values converge to a fixed number and the eventual values of the fundamental parameters are

DI	APD	cycle length CL = APD+DI
59.4 ms	173.6 ms	233 ms

The fixed, limiting DI value 59.4 represents a stable *convergent state*. This equilibrium DI is locally stable (attracting) because

$$A'(59.4) + C'(59.4) = 0.90 < 1.$$

**Supplement 2:** This supplement extends Case-study 2 in the Model Description by considering a different length for the loop. With  $L = 13.5$  cm the equilibrium DI is unstable (repelling) because

$$A'(65.5) + C'(65.5) = 1.14 > 1.$$

Hence the convergent state is absent. However, there are at least two distinct stable oscillatory states both of which satisfy TC (one occurs around all initial DI of 65 ms). Both of these states come close to the threshold value  $DI^*$  so locking into reentry mode is not assured. The following table summarizes the results of simulations with  $m = 135$  or  $L = 13.5$  cm (as in the Model Description, the bar notation is used to indicate repetitive patterns):

$DI_{i,0}$ , $i = 1, \dots, 135$	SITR pattern mode sequence
220, 210, 200 ms	$\{-2, 2, -2, 2, -2, 7[29], -1, [9], -2, 9[9]\}$
190, 180, 170, 160 ms	$\{-2, 2, -2, 2, -2, 7[29], -1, [8], -2, 9[8]\}$
150 ms	$\{-2, 4, -2, 121, -1, \infty\}$
140, 130, 120, 110, 100 ms	$\{-2, 4, -2, \infty\}$
90 ms	$\{-2, 14, -2, 9\}$
80 ms	$\{2, -2, 2, -2, 2, -2, 7[29], -1, [9], -2, 9[9]\}$
70 ms	$\{12, -2, 14, -2, 9\}$
60 ms	$\{11, -2, 2, -2, 2, -2, 7[30], -1, [9], -2, 9[9]\}$
50 ms, 40 ms	$\{1, -2, 9\}$
30 ms, 20 ms	$\{-\infty\}$ (no reentry initiated)

In the 150 ms case, the -1 term is due to failure of TP (pacers pulse enters the loop). TP also fails in the cases 30 ms and 20 ms in Beat 1.