Problem 6.1

Convert the hybrid automaton $H$ below into a linear hybrid automaton using clock translation. What is its long-term period? (i.e., its period after any transient has died away?)

Hint: compute the time derivative of $\tan t$ (and re-write it in terms of $\tan t$).

Problem 6.2

(a) Convert $H$ below into a rectangular hybrid automaton using linear phase-portrait approximation. What are the bounds on its long-term period?

(b) By splitting two of the states, what are the best bounds that you can obtain?

Problem 6.3

Modify the marked sections of the Matlab function ha.m (handed out in class and available on the course web page) to simulate the DC/DC buck converter discussed in class. Implement the equations directly using an if statement. There is no need to use event catching! Use $E = 25$, initial voltage equal to 11.8, and initial current equal to 0.6.

Run your script using Matlab and produce a plot of voltage versus time (which will automatically be plotted if you choose $y(1)$ to be voltage, $v$). Compare your answers with those shown in class.

Problem 6.4

Modify the marked sections of the Matlab function haz.m (handed out in class and available on the course web page) to simulate $H$ below. What is its long-term period?

You may wish to also look at myballode.m (handed out in class and available on the course web page) and read its comments.

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Hybrid Automaton $H$