Optimization Problem

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1 Problem

Algorithm:
set $t_0 = 0$
while $t_i < t_{final}$
for $i = 1$..... to end
solve : $min_{t_i} - t_i - \alpha \int_{t_{i-1}}^{t_i} ln(v(t))dt - \alpha \int_{t_{i-1}}^{t_i} ln(v_{thresh} - v(t))dt$
$s.t \quad v' - av = I(t), \quad t_i > t_{i-1}, \quad v(t_i) = v(t_{i-1}) = 0$
end
On the last interval $[t_i, t_{final}]$ we gaurentee the solution will not jump, therefore we only need to solve the ODE with initial condition $v(t_i) = 0$ α is barrier parameter (small i.e 10^{-6}). We can eventually get derivatives with this approach. The barrier terms enforce that we require $0 \leq v(t) \leq v_{thresh}$ for all t.