Numerical Methods: Adaptive Integration

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Enabling adaptive integration

Use variable dt
Absolute Tolerance 0.001
Atol Scale Tool Details

\texttt{h.cvode\_active(1)}

\texttt{h.cvode\_active} is defined in \texttt{stdrun.hoc} which is loaded automatically whenever the \texttt{gui} is imported.
This is a composite image, not a screenshot to allow combining the window decoration and vector-based window contents.
Options: per state variable tolerance, integration methods

- **Use variable dt**
  - **Absolute Tolerance**: 0.001

**Numerical Method Selection**
- Current model type: ODE
- ODE model allows any method
- DAE model allows implicit fixed step or daspk
- Implicit Fixed Step
- C-N Fixed Step
- Cvode
- Daspk
- Local step
- DAE and daspk require sparse solver, cvode requires tree solver
- Mx=b tree solver
- Mx=b sparse solver
- 2nd order threshold (for variable step)
Mainen & Sejnowski 1996, Figure 1D, fixed step: 9.49s

Code for this model is available at: http://modeldb.yale.edu/2488
Timings ran with NEURON 7.5 (cbd6261ecbad) on a 3.4 GHz i7-4770 with 24 GB RAM via the Windows Subsystem for Linux in Windows 10.
This is a composite image, not a screenshot to allow combining the window decoration and vector-based window contents.
Mainen & Sejnowski 1996, Figure 1D, variable step: 1.4s

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Timings ran with NEURON 7.5 (cbd6261ecbad) on a 3.4 GHz i7-4770 with 24 GB RAM via the Windows Subsystem for Linux in Windows 10.

This is a composite image, not a screenshot. Due to pdf rendering problems, the original checkmarks have been replaced.
A closer look at change, time steps, and order

Results shown are for variable step method for Mainen & Sejnowski 1996, Figure 1D.
Suppose we inject a current pulse to trigger an action potential that we record at a fixed rate. We then use this time series for a voltage clamp experiment on an identical cell.

What are the dynamics of the current that must be injected through the voltage clamp?
Fixed step (same timestep)
Variable step

Graph NewView x -0.5 : 5.5 y -92 : 52

Graph NewView x 0.74 : 1.46 y -74 : -2

Graph Crosshair x -0.5 : 5.5 y -1.2 : 1.2

Graph Crosshair x 0.74 : 1.46 y -0.6 : -0.8
Variable step with linear interpolation

\[ \text{vvec.play(h.SEClamp[0].ref, amp1, tvec, 1)} \]

The last argument of 1 indicates that the values at intermediate time points should be estimated by linear interpolation.