Physical Computing for Hopfield Networks on a Reconfigurable Analog IC

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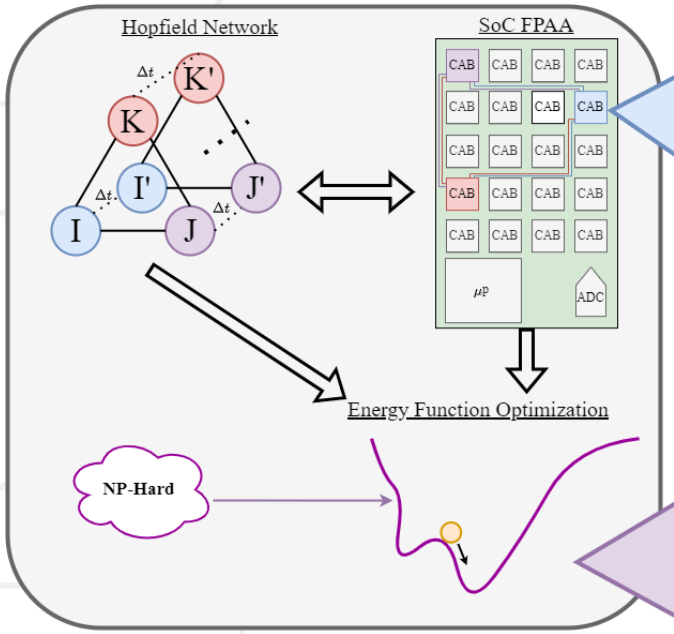
Analog Hopfield Network

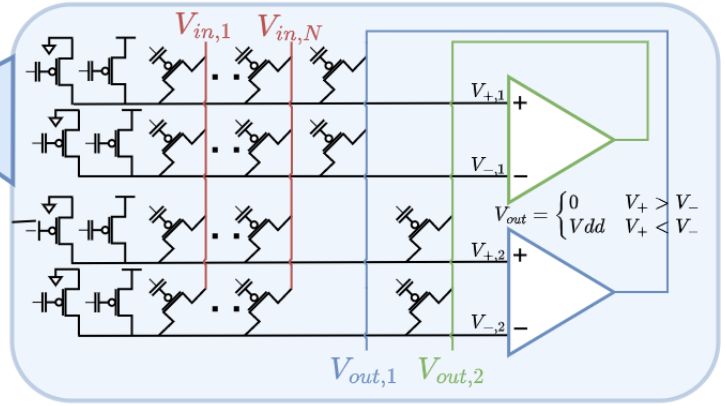


- Hopfield Network minimizes energy

$$E(t) = -\frac{1}{2}\mathrm{v}^T\mathrm{W}\mathrm{v} - \theta^T\mathrm{v}$$

- Can map hard problem to E(t)
- Analog implementation saves
  - Power, space, time

Circuit

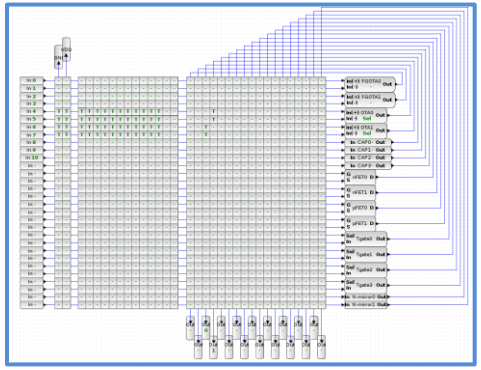


Solving Max-Cut

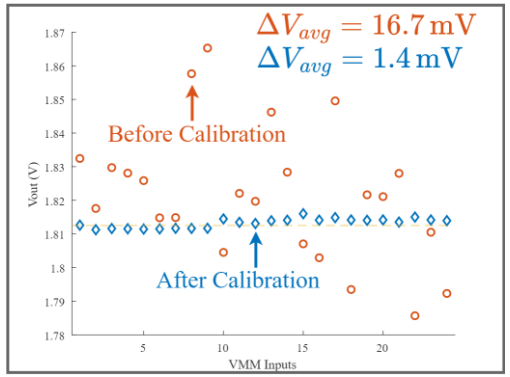
$$W_{ij} = \begin{cases} -W, & E_{ij} \subset E \\ +W, & E_{ij} \not\subset E \end{cases}$$

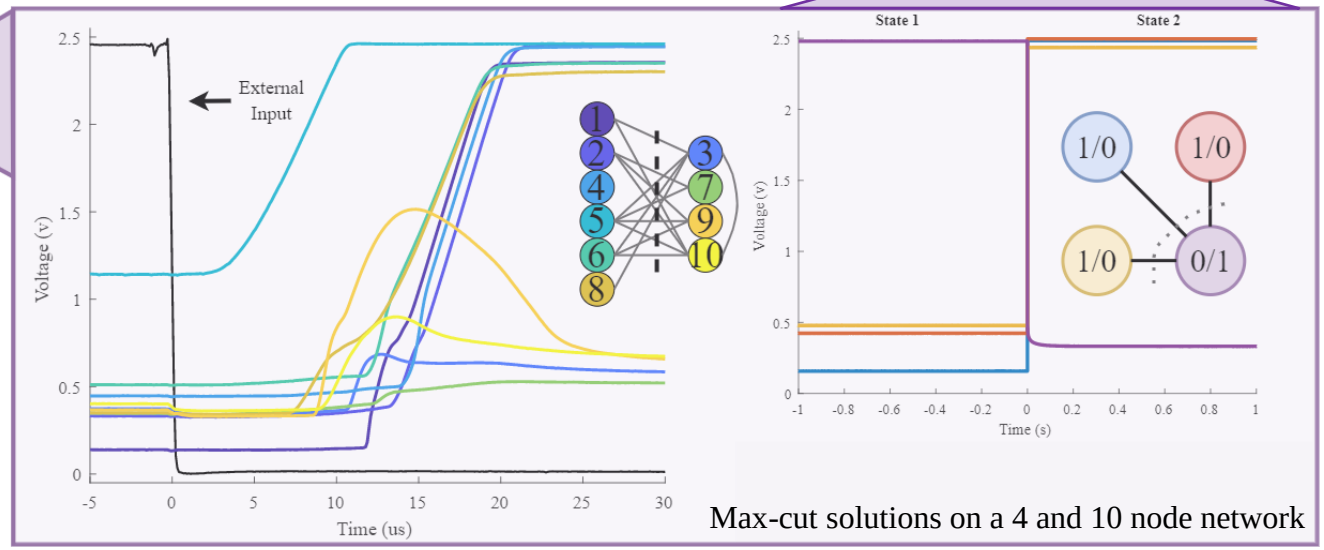
- Solved on 4 and 10 node networks
- Switching between stable states
- Convergence in microseconds

MacroCab



Calibration





Max-cut solutions on a 4 and 10 node network

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