

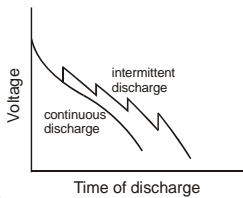
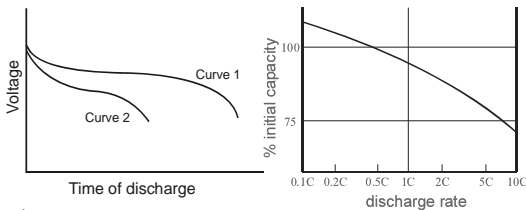
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Introduction



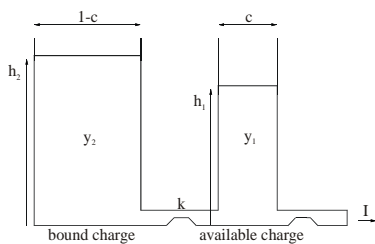
Is it possible to improve battery lifetime for a given load?

Battery physics



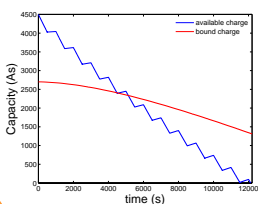
- Voltage drops during discharge
- Capacity decreases for high discharge currents
- Battery can recover during idle periods

Kinetic Battery Model

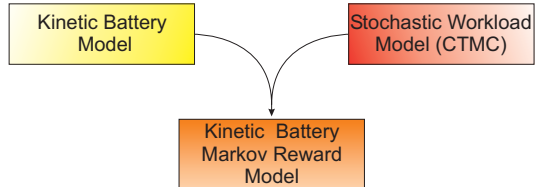


$$\frac{dy_1}{dt} = -I + k(h_2 - h_1) \quad h_1 = \frac{y_1}{c}$$

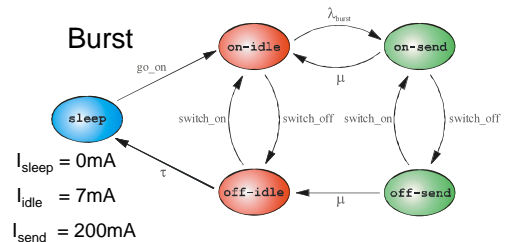
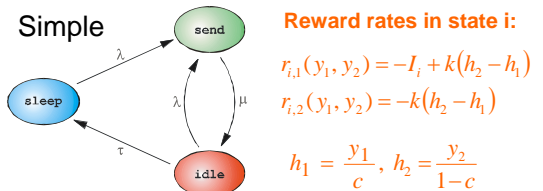
$$\frac{dy_2}{dt} = -k(h_2 - h_1) \quad h_2 = \frac{y_2}{1-c}$$



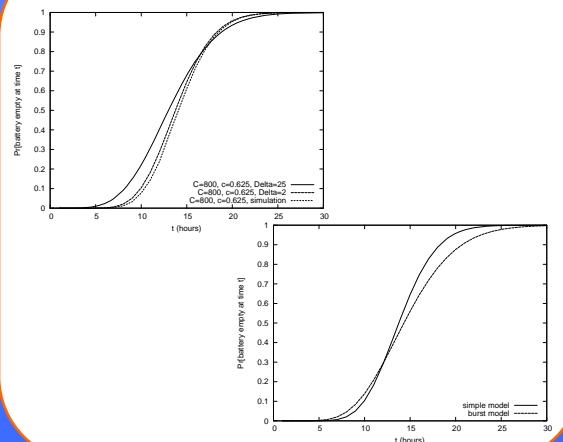
Frequency (Hz)	Exp. lifetime (min)	KiBaM lifetime (min)
Continuous	90	91
1	193	203
0.2	230	203



Stochastic workload models



Battery lifetime distributions



References

V. Rao, G. Singhal, A. Kumar and N. Navet, "Battery model for embedded systems" in VLSID '05: Proceedings of the 18th International Conference on VLSI Design held jointly with the 4th Conference on Embedded Systems Design, 2005

L. Cloth, B.R. Haverkort, M. Jongerden, "Computing Battery Lifetime Distributions" to appear in DSN '07: Proceedings of the 37th IEEE/IFIP International Conference on Dependable Systems and Networks, 2007