Energy Curve Engineering

Personnel
M. Bhardwaj (A.P. Chandrakasan)

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The area of low power electronics has received aggressive research attention in the past decade or so. Most research that has demonstrated orders of magnitude power reduction has done so by a combination of two major approaches. On the one hand, broad techniques like exploiting parallelism have been employed. On the other, ad-hoc and problem specific redundancies are eliminated by iteration and by exploiting recurring computational patterns.

We are investigating a new technique termed “Energy Curve Engineering” that can be used as a formal basis for re-engineering systems as simple as multipliers to as complex as wireless networks. Energy curve engineering aims to exploit knowledge of the desired quality histogram and redesign the energy/quality curve (via algorithm, architecture and circuit modifications) such that the overall energy is minimized. The approach is general and has the potential for near universal application.

ECE includes interconnect costs and shows how the lower bound on dissipation is objectively related to energy costs of interconnect. The most significant contribution, however, is the fact that ECE theory can be translated into practice using the idea of “Ensemble of Point Systems (EoPS)”. In brief, the EoPS idea simply states that practical, near-optimal energy efficient systems can be systematically derived from provably optimal ones by a systematic choice of sub-components. We have tested the technique with good results on datapath elements. We will next test it on filtering and then on communication transceivers. After that, we will employ ECE to the global μAMPS network.