Computation model and higher-dimensional tilings

Antonin Callard[*,1]

[1]GREYC, Université de Caen – Université de Caen – France

Résumé

Most computability results on subshifts are proved on Z^2 by embedding arbitrary computations of Turing machines, which classically consists in drawing the space-time diagram of the Turing machine (one dimension being used for space, one dimension being used for time) ; and then, said results generalize to higher dimensions by reducing to the two-dimensional case.
These reductions between the 2 and the d-dimensional case have left a gap in my understanding of how we compute with subshifts: how do you embed arbitrary computations in a d-dimensional tiling? For example, if you draw the space-time diagram of a Turing machine on Z^3, do you use one dimension for space, and two for time? This appears to suggest a tradeoff between time and space when dealing with d-dimensional computations.
In this talk, we show that there is, in fact, no tradeoff. By considering "mesh-connected multicomputers" as a computation model, one can implement the sorting of an array of size $(0,n)^{d-1}$ into a tiling of the $(0,n)^d$ cube. From this, we can embed $O(n^{d-1})$ steps of arbitrary word-RAM computations into a tiling of the $(0,n)^d$ cube.

[*]Intervenant

sciencesconf.org:sda2-2025:649443