

Report on the thesis of Antonio Vitale

by Catuscia Palamidessi

February 1, 2010

Title: Expressiveness in biologically inspired languages

Summary:

The thesis investigates the use of process calculi to model and analyse biological systems.

This is a novel and exciting area of research, looking very promising from the point of view of allowing formal reasoning about these systems. The thesis focuses on one of challenges of this approach, namely the assesment of the expressive power of these formalisms, between themselves and in comparison to the systems to be modeled.

The thesis contains several interesting contributions:

- An encoding of Simple Symport/Antiport P systems into a version of the Brane calculus.
- A solution of the self-assembling problem of the k-calculus into the nano k-calculus. This solution introduces divergency, but on the other hand, the thesis shows that it is not possible to have deterministic solutions preserving the termination properties.
- An impossibility result about encoding the n-way synchronization into (n-1)-way synchronization, in the scope of k-calculus. This is proved in an elegant way by using a famous consensus problem: the symmetric leader election on a suitable topology.
- A similar impossibility result in the context of CCS. Despite the similarity of the problem, the reasoning technique needs to be different due to subtle differences between the k-calculus and CCS. This latter result is proved by using another famous problem (of resource-sharing): the dining philosophers.

Recommendation:

The results of the thesis are original, significant, technically nontrivial, and surely adequate for a PhD thesis. The presentation is polished and clear. The overall impression is that the problems are understood in depth, and the proposed solutions are original and insightful.

In conclusion, I consider this thesis to be of high quality and I strongly recommend that the candidate be allowed to defend it.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Catuscia Palamidessi', with a stylized, cursive script.

Catuscia Palamidessi
Director of Research