Conference Session/Topics : **Nanomaterials Fabrication, Characterization and Tools /Modeling and Simulation at the Nanoscale**

First steps towards instantaneous positioning of Nanorobots equiped with graphen antenna in large scaled nano-systems

Dermas Moffo[1] , Philippe Canalda[1]
[1]Femto-st Institute (UMR CNRS 6174). Department of Complex Systems, University of Bourgogne-Franche-Comté, Monbéliard, FRANCE – {Surname.Name}@femto-st.fr

Abstract:
The development of new materials such as graphen, a sheet of the thickness of one atom, consisting of carbon atoms arranged in a hexagonal pattern, enables the fabrication of new nano-devices. The expected frequency of nano-transmitters and nano-graphen-based antennas is of the order of terahertz, resulting in nano-wireless communications between nanorobots [1]. Nanorobots with these means are used in different applications to carry out actions or for the contruction of 2D and 3D smart-forms (programmable matter – Claytronics[2]).
These applications often require (to be completed), a precise knowledge of the position of the nanorobot. In many cases, it is more useful to have a local information on the relative position of nanorobots and their orientation, than a global position (or absolute position) of each robot.Previous work on nanorobots micropositioning are either stochastic [3] and based on probabilistic approaches, which give better results on a small sample, but produce a larger error due to accumulation with a large scale; either deterministic and are based on geometrical considerations to calculate accurately the position of each item.
In this work, we propose a model of a smartgrid (orthogonal and hexagonal lattice) of nanorobots regular geometry, and their connectors (actuators and sensors for displacement and other actions) communicating by contact. Based on this model, we propose a mixed positioning algorithm (absolute and relative) in 2D and 3D without mobility of nodes in a group ranging in size from thousands to millions of items, based on neighborly relations and on geometrical considerations to calculate accurately the position of each item, and then distribute it to all the elements of a large grid. Then by simulation we perform a functional validation of our algorithm, and a validation of the scalability of our algorithm on an orthogonal grids of one million nodes.

Keywords: 2D and 3D Nano-localization, relative and global positioning, Nano-systems, localization algorithm, simulation.

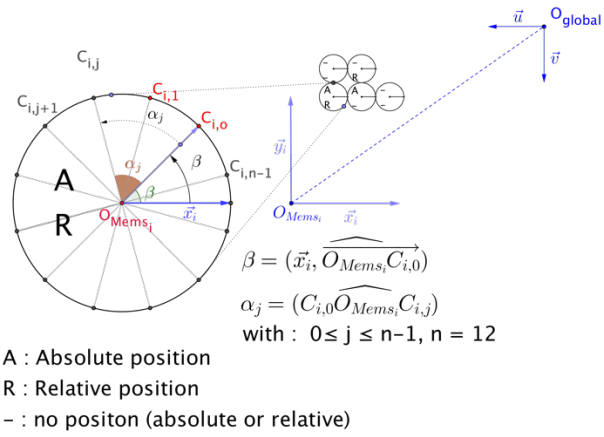

Figure 1: Mems regular geometry (nanorobot) + connectors form, within an orthogonal grid, in an absolute reference frame environment.

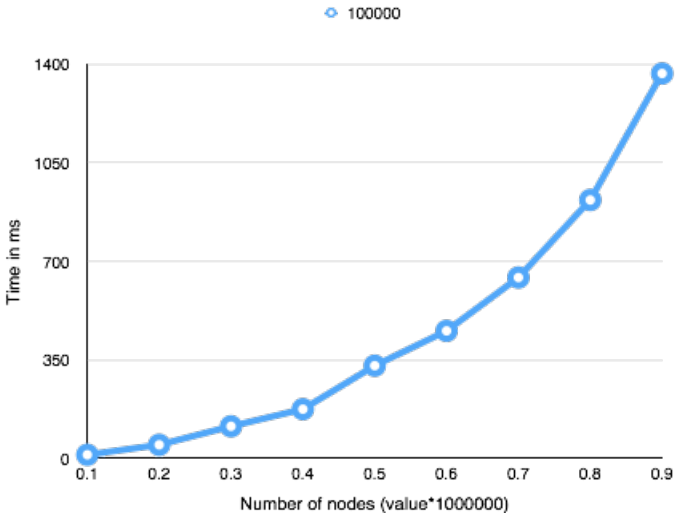

Figure 2: Average simulation time for positioning a set of nanorobots whose size ranges from 100000 to 900000.

References:

[1] Jornet, J. M., Akyildiz, I. F. "The internet of multimedia nano-things". Nano Communication Networks, 3(4), 242-251, 2012.
[2] Goldstein, S. C., Mowry, T. C." Claytronics: A scalable basis for future robots". Published in the procedings of RoboSphere 2004, http://repository.cmu.edu/compsci, 6pages.
[3] Funiak, S., Pillai, P., Campbell, J., & Goldstein, S. C. (2007). Internal Localization of Modular Robot Ensembles. Published In the public access proceding of Workshop on Self-Reconfiguring Modular Robotics at the IEEE International Conference on Intelligent Robots and Systems (IROS) '07, http://repository.cmu.edu/compsci, 6 pages.