

## **Distributed Assembly Algorithm Design & Experimental Evaluation for Lily Robots**

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**Lily robots** are small floating square robots, which can link to each other with magnets. Since they do not have a way to move by themselves, they are inserted in a water pool agitated with pumps. Random collision will occur between them and they will aggregate in one or several shapes.



**This project** aimed at developing a grammar for the self-assembly process of the Lily robots, using rulesets. The focus was put on local rules corresponding to the neighbour to neighbour communication of the Lily robots, as well as adding geometric constraints to the rules, to control the shape formed by the robots.

In this scope, rulesets algorithms from the literature were adapted and improved in Matlab. They were compared with simplified simulations of the Lily stochastic environment and some conclusions were made on their performances in terms of yield and convergence time.

The rulesets were then implemented on the Lily robots, and tested in experiment. Some limitations were observed, which led to improvement suggestions for both the ruleset algorithms and the Lily code.

The whole programming part of the project was designed to be reusable and modifiable in the future, and has been properly documented. Specifically, a workflow was developed to test any reachable self-assembly target structure, choosing an algorithm to generate its ruleset, either simulate it or implement it in the Lily code and finally using some results analysis tools.

