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Modelling a Deposition Process in Collective Construction

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Abstract: During collective construction tasks, swarm robots coordinate their actions in space and time to build structures that conform to some given design or specification. In this paper, a simulation model and a mathematical model (based on a Markov chain) are introduced to describe the deposition process of a previously detailed robotic swarm system that uses templates and feedback to facilitate construction. The models are based on the behaviour and geometry of real robots and predict the dynamics observed during practical trials as well as explaining the occurrence of different spatial patterns of building blocks. Furthermore, the models provide an insight into the swarm system and a solid basis for understanding the feedback mechanism that is fundamental to its operation. The theoretical models are verified with practical trials performed by physical robots.

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