GEOMETRY AND STRUCTURES IN SELF-STABILISING POPULATION PROTOCOLS

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Population protocols provide a foundational model for analysing the computational capabilities of systems composed of simple, indistinguishable agents interacting in pairs. Each agent has only minimal memory, represented by its current state from a fixed state set. In the classical setting, a protocol starts from a well-defined initial configuration encoding the input and must stabilise to a correct final configuration. Self-stabilising population protocols relax this requirement by allowing the system to begin in an arbitrary configuration. Such a protocol must ensure that, regardless of the starting state, the system eventually converges to a correct and stable configuration.

This presentation will focus on several core tasks in this framework, including ranking, leader election, and distributed positioning in models enriched with geometric or spatial queries. The discussion will highlight recent developments, such as improved efficiency bounds for near-state-optimal and state-optimal self-stabilising leader-election protocols, as well as new methods for anonymous self-stabilising localisation using spatial population protocols.