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Aggregation, Foraging, and Formation Control of Swarms with Non-Holonomic Agents Using  
Potential Functions and Sliding Mode Techniques

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**Abstract:** In this article we consider the aggregation, foraging, and formation control of swarms whose agents are moving in 2-dimensions with non-holonomic unicycle agent dynamics. We approach these problems using artificial potentials and sliding mode control. The main contribution is extension of the recent results (mainly for aggregation) in the literature based on a similar approach for simple integrator agent dynamics models to a significantly more realistic and more difficult setting with non-holonomic unicycle agent dynamics models. In particular, we design continuous-time control schemes via a constructive analysis based on artificial potential functions and sliding mode control techniques. The effectiveness of the proposed designs are demonstrated analytically as well as via a set of simulation results.

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