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New Approaches to Convex Polygon Formations

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This in-progress study considers innovative approaches to the multi-agent formation of convex polygons via a two-phase procedure. Both regular and non-regular formations are investigated. The methodology infuses features from the behavioral and virtual structure methodologies. In the first phase, the agents form a circle. The circle formation plays a fundamental role in improving reconfiguration of virtual structures that are often faced with challenges. In the second phase, the agents are reconfigured into a polygon formation inscribed in the circle.

The study has revealed three geometrical methods to the second phase using: 1) Triangulation, 2) Systems of linear equations, and 3) Vector analysis. In comparison to other research works: 1) The circle pre-reconfiguration improves the reconfiguration process of virtual structures, 2) No distinction is made among the agents, 3) Agents are able to avoid collisions, and 4) The dimension of polygons does not depend on the number of agents deployed. Simulation results show precise formation of agents with the ability of continuous reformations. The results further indicate that the proposed approach has the potential to rotate or change the location of formation while maintaining the formation.

Keywords: Consensus, Cyber physical systems, Peer-to-Peer networks