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On the Inability of Gathering by Asynchronous Mobile Robots with Initial Movements

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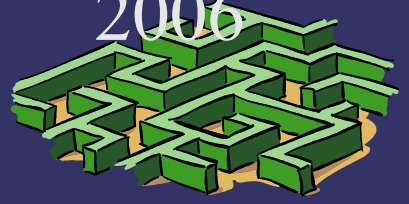
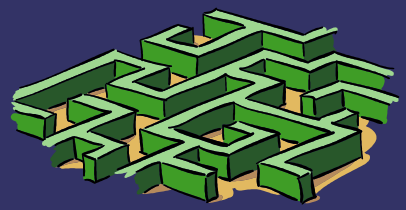


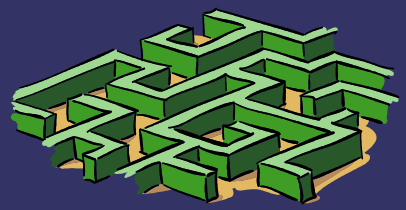
1. Model definition

- Comunity of robots
- Anonymous
- Fully asynchronous
- No common origin
- No common unit of distance
- No common sense of direction
- No direct communication



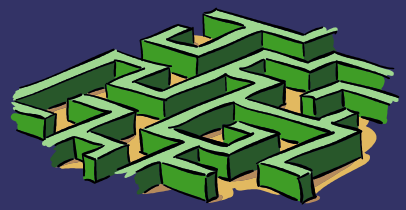
1.1 Robots

- Sensors to detect the instantaneous positions of other robots
- Infinitely small (points)
- Unbounded Euclidean plane
- Never colide, can occupy the same location
- Observe, compute, move with infinite precision
- Deterministic
- Oblivious



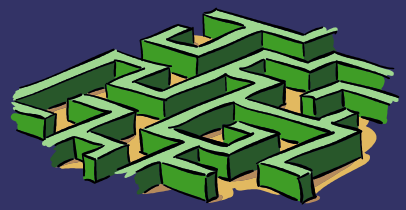
1.2 Scheduling

- The cycle of robots' lives
  - Wait
  - Look
  - Compute
  - Move
- Each phase can take arbitrary long, but finite time
- No state preserved from previous cycles



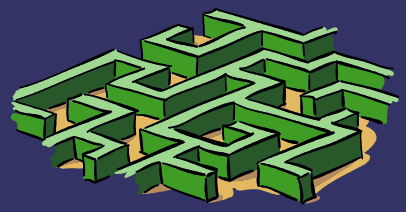
1.3 Traditional initialization

- All robots are initialialy not moving
- Algorithms able to prevent certain configurations
- Robots cannot be ever pushed



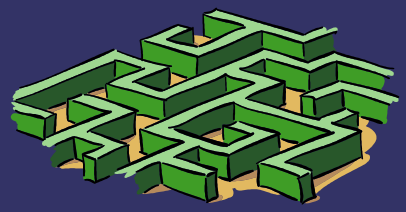
1.4 Initialial movements

- Robots are initialy moving to arbitrary point
- Algorithms must solve all configuration
- Robots can be pushed few times



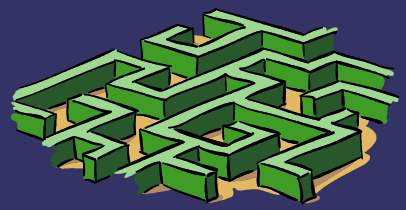
2. Gathering problem

- Given a group of robots in the plane
- Arrange them at one point on the plane in finite time
- Solvable for zero initial movements with multiplicity detection for n>2



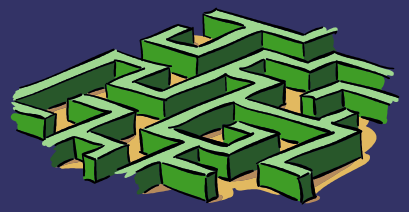
2.1 Inability of gathering

- Force robots to repeat two similar configurations
- Repeat the scheduling infinitely

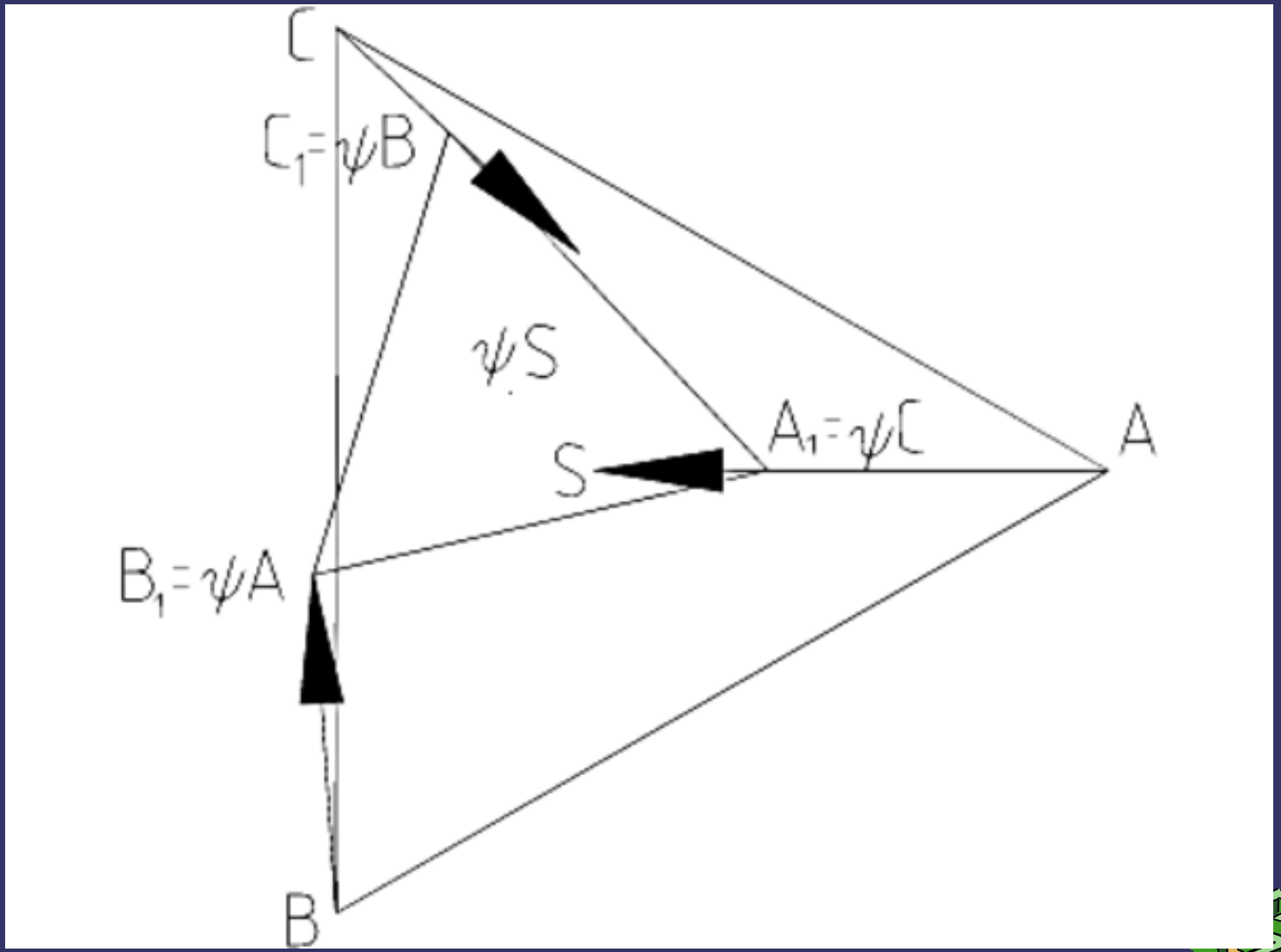


Regular circle snapshots

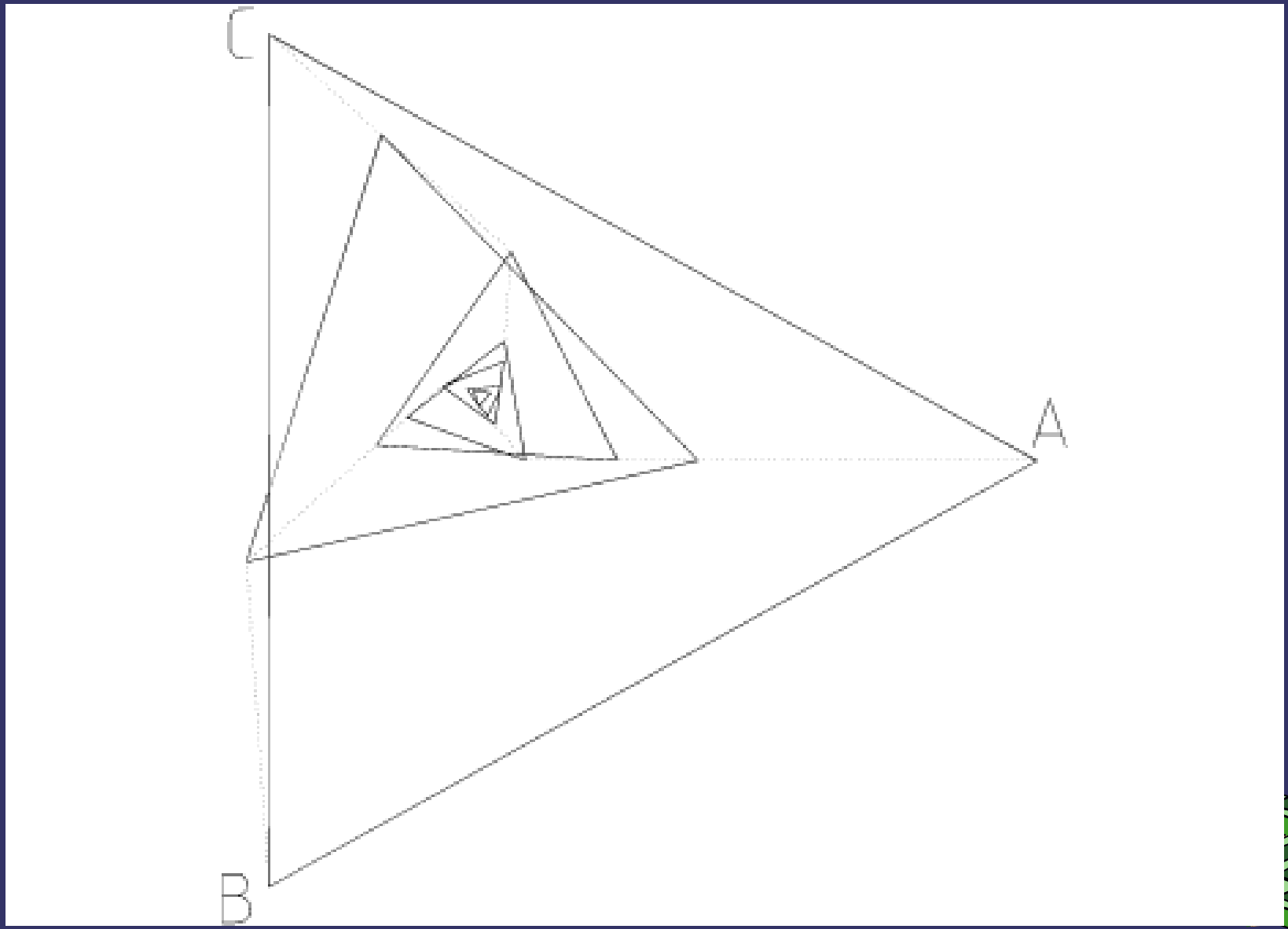
- Robots must choose the center
- If not, similar snapshots can be achieved

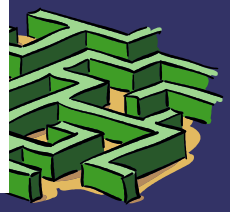


Pattern construction



Pattern simulation





Conclusions

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