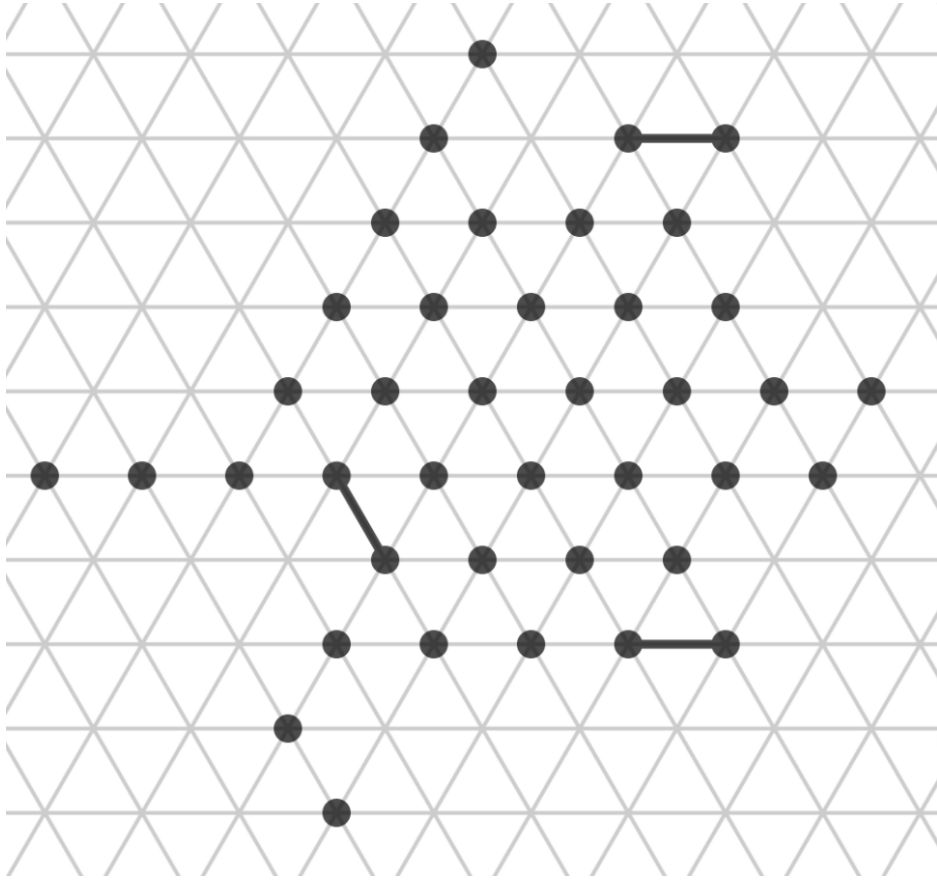
Reconfiguration and Locomotion with Joint Movements in the Amoebot Model

Andreas Padalkin, Manish Kumar, Christian Scheideler

**Supported by the DFG Project SCHE 1592/10-1
and the Israel Science Foundation under Grants 867/19 and 554/23**

Geometric Amoebot Model



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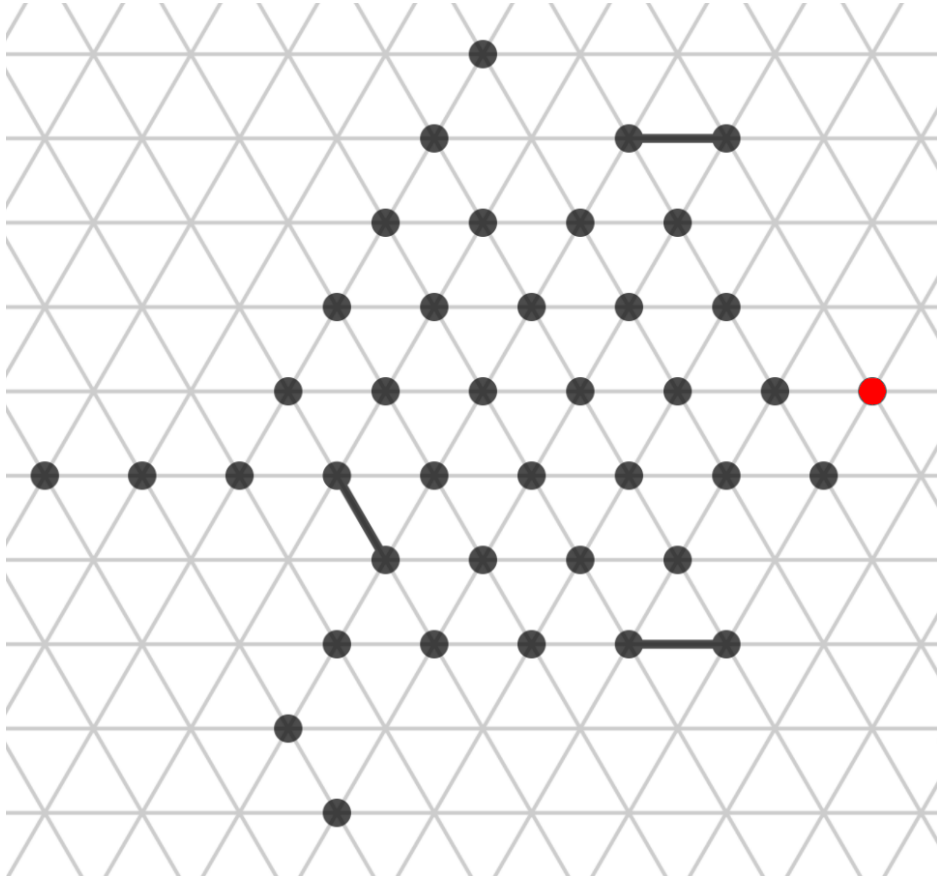

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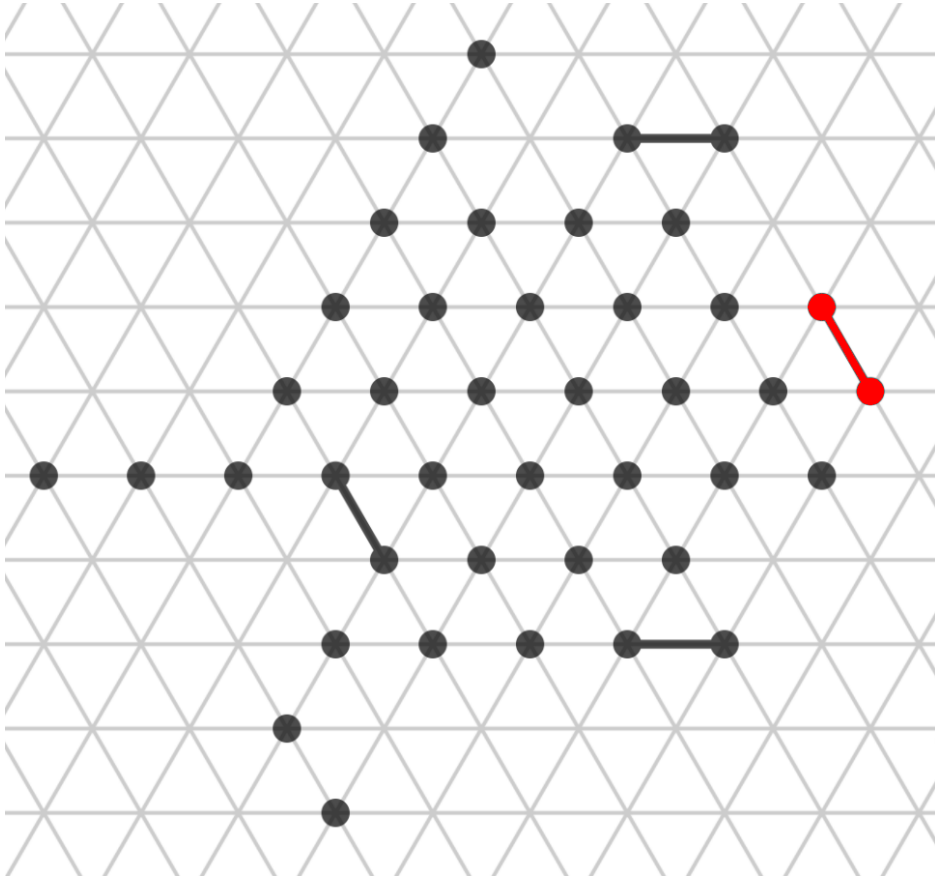
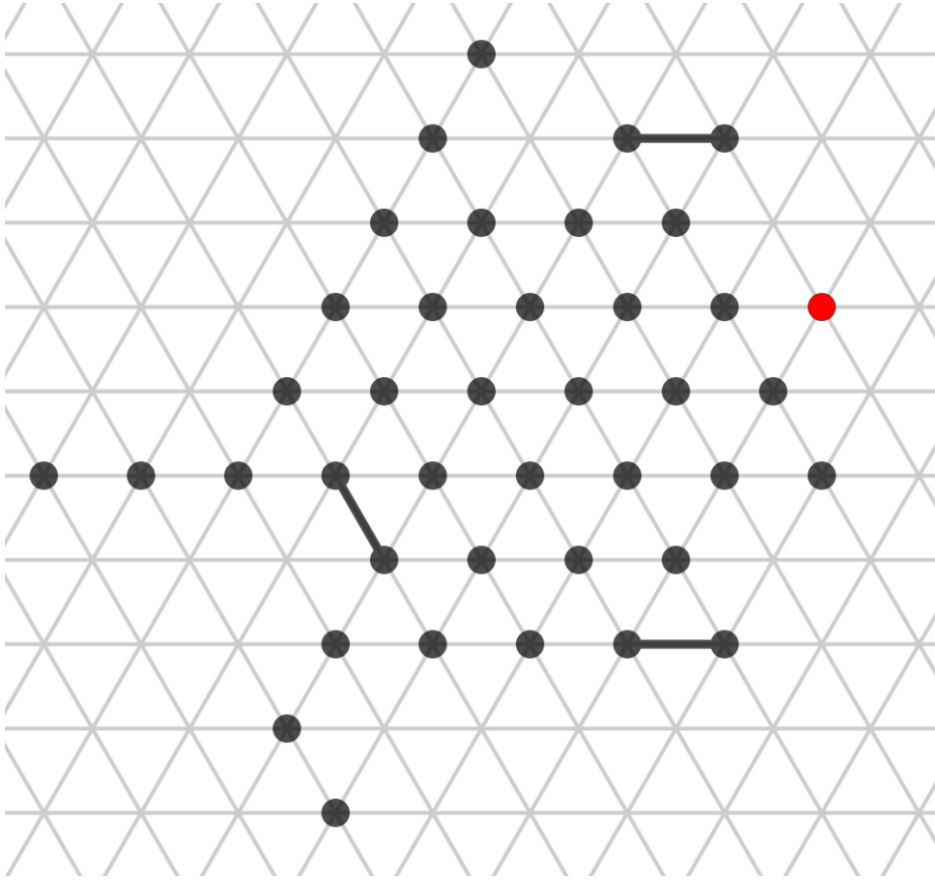
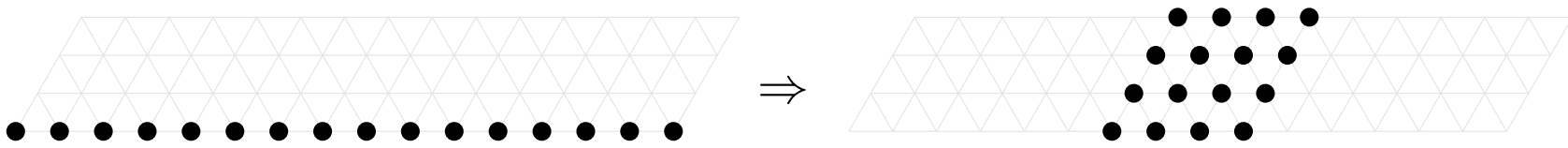


Geometric Amoebot Model

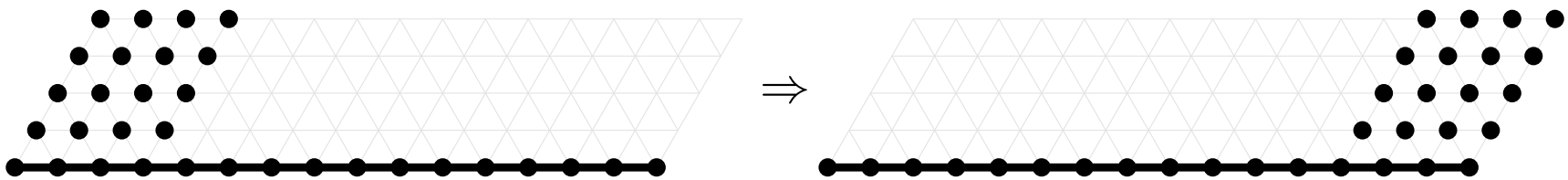


Geometric Amoebot Model

- Reconfiguration



- Locomotion



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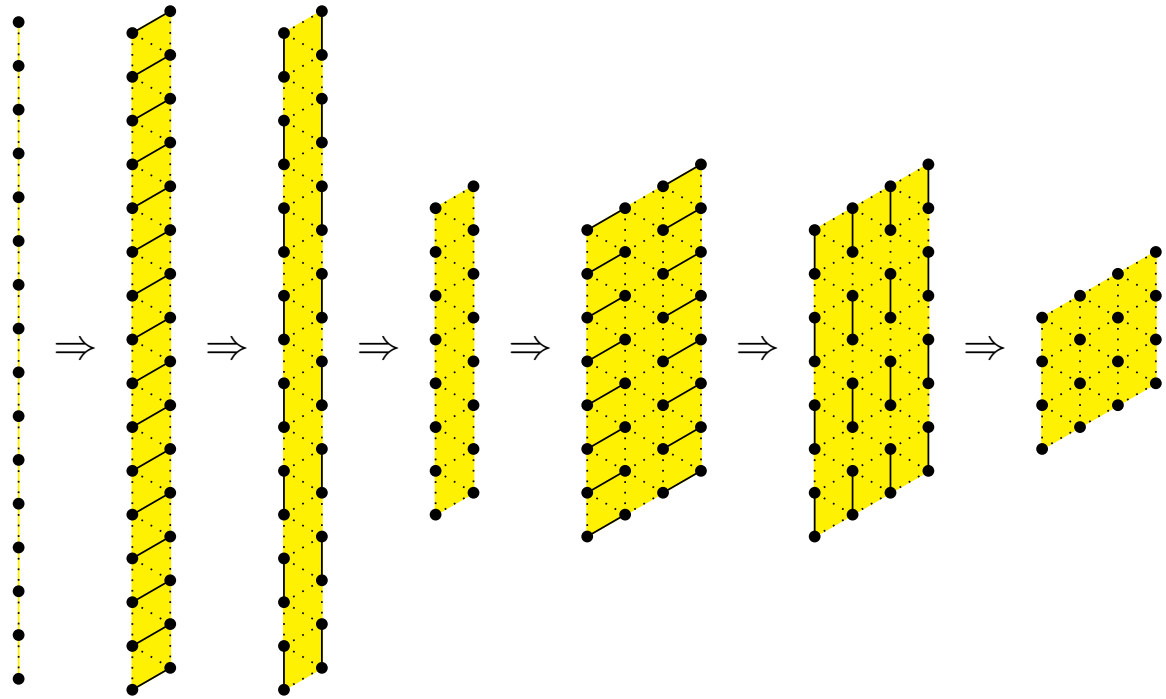
Joint Movement Extension



Feldmann, Padalkin, Scheideler, Dolev:
Coordinating Amoebots via Reconfigurable Circuits.
J. Comput. Biol. 2022

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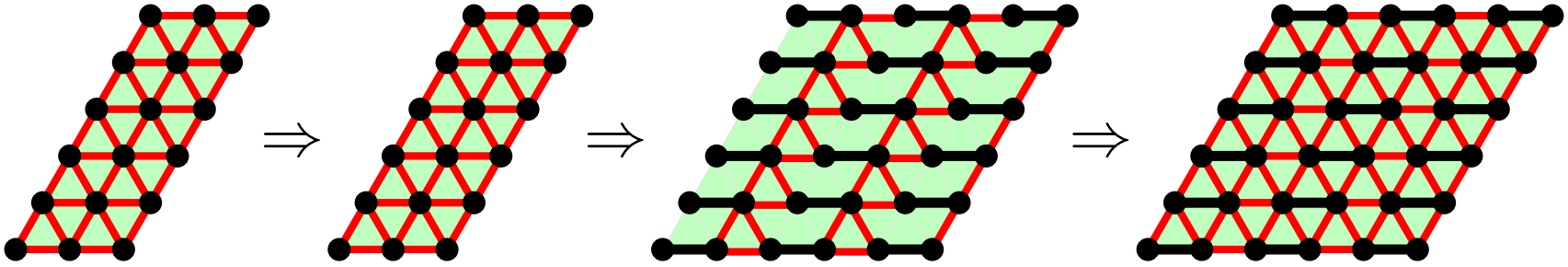
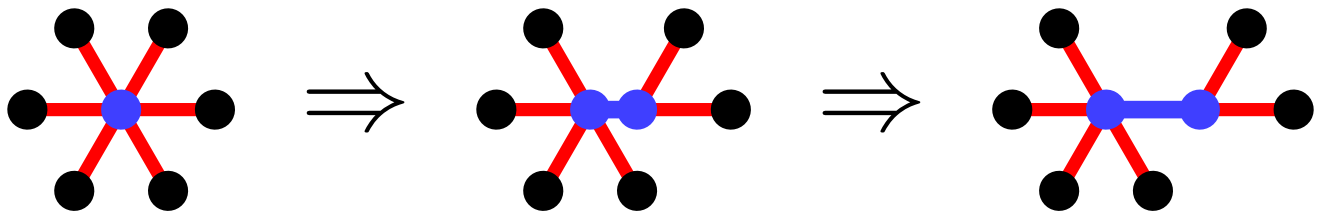
Joint Movement Extension: Expansion





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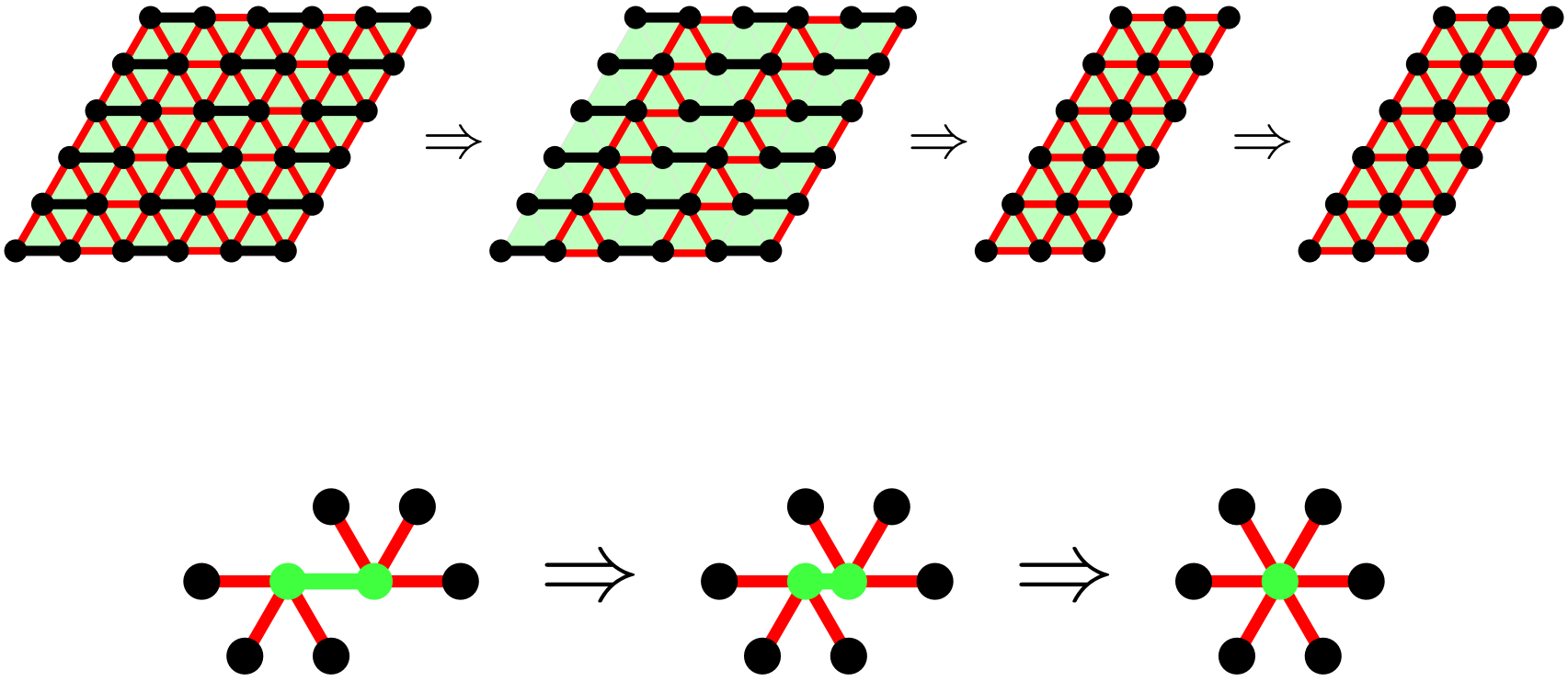
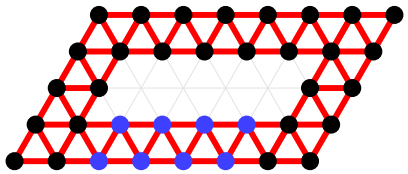
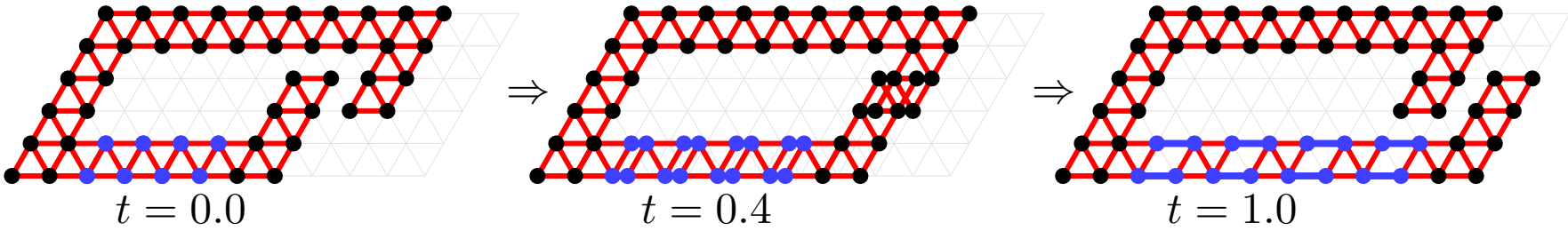
Joint Movement Extension: Contraction



Joint Movement Extension: Conflicts and Collisions





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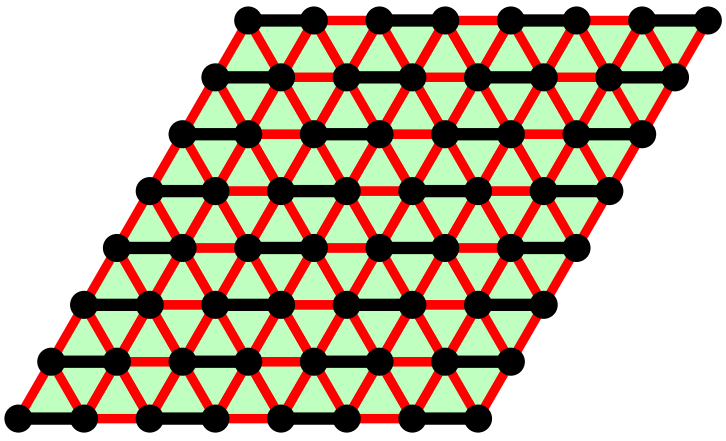
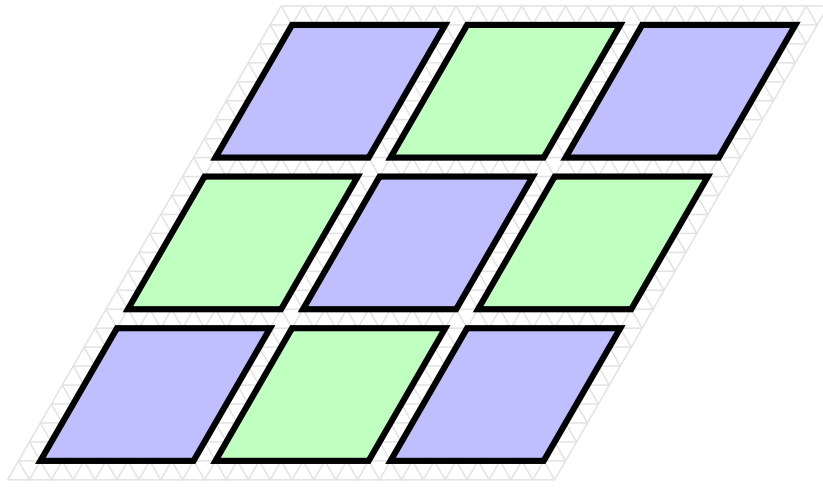
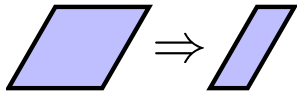
Rhombical Meta-Modules

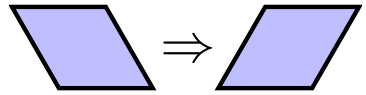




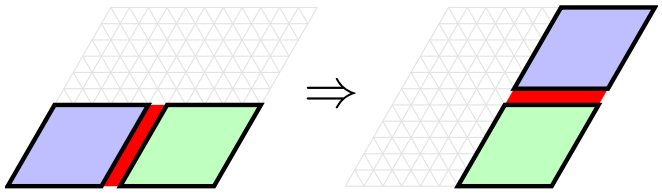
Rhombical Meta-Modules: Movement Primitives



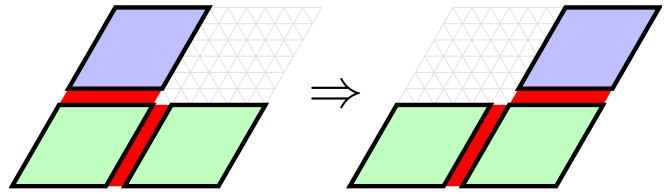
(a) Contraction primitive



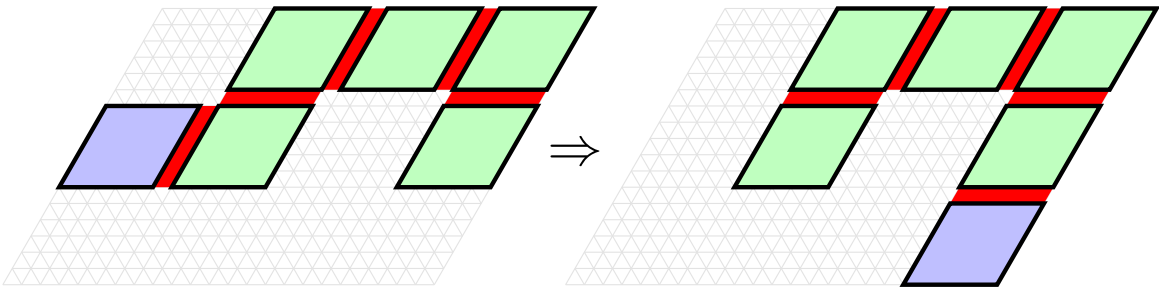
(b) Realignment primitive



(c) Rotation primitive



(d) Slide primitive



(e) Tunnel primitive

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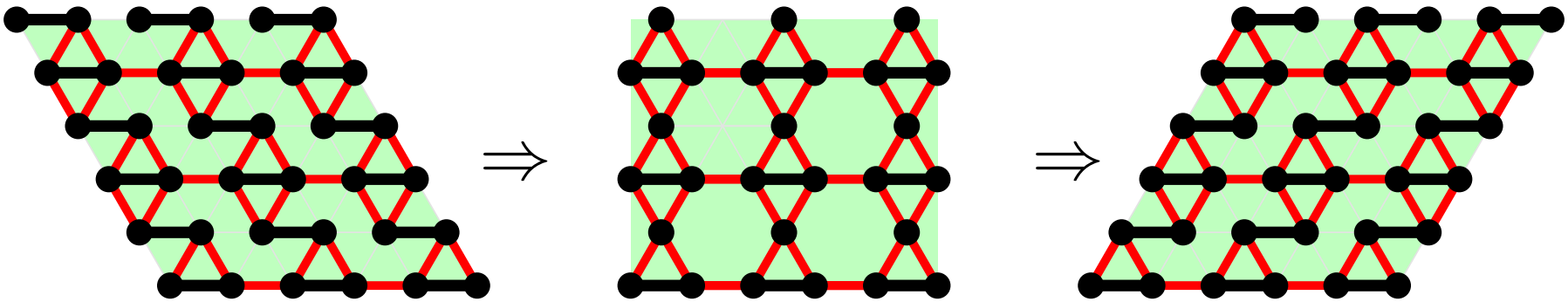
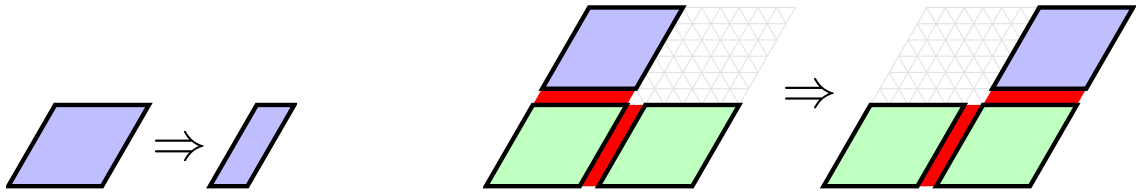
Rhombical Meta-Modules: Realignment Primitive



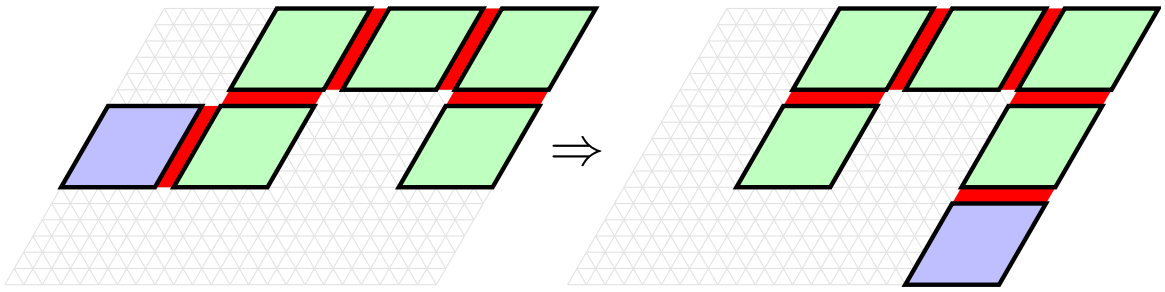
Reconfiguration

- **Crystalline Atoms**
  Aloupis, Collette, Demaine, Langerman, Adinolfi, Wuhrer:
  Reconfiguration of cube-style modular robots using $O(\log n)$ parallel moves.
  ISAAC 2008



(a) Contraction primitive

(b) Slide primitive



(c) Tunnel primitive

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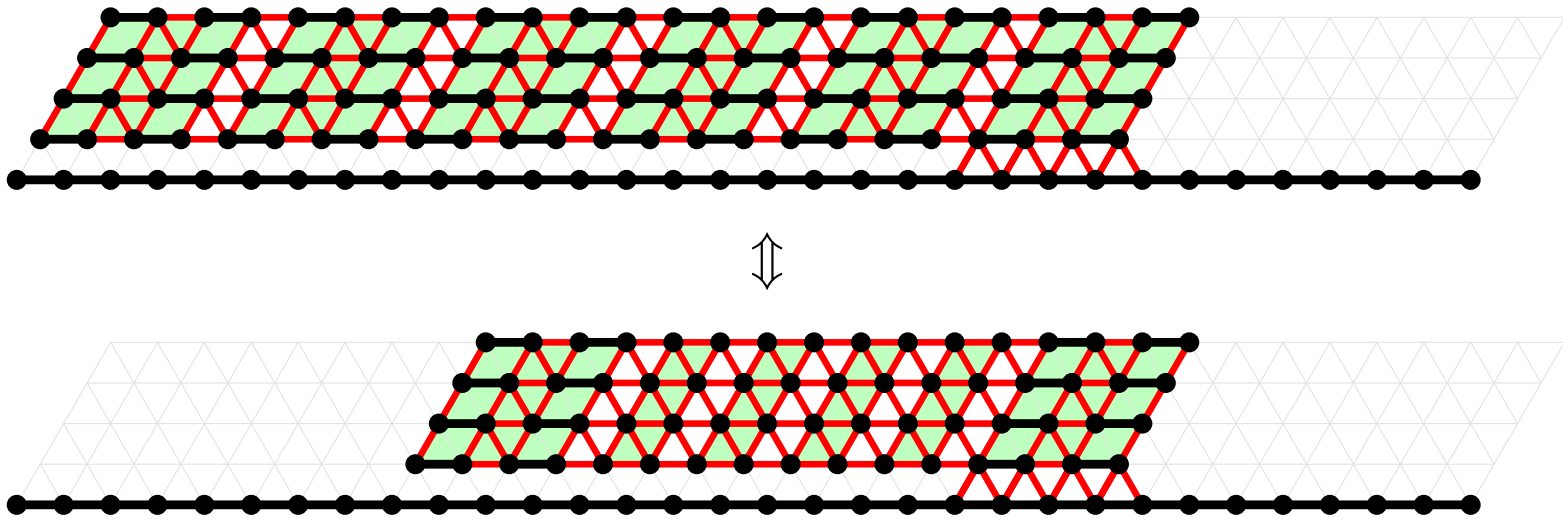
Locomotion: Crawling Worm Structure



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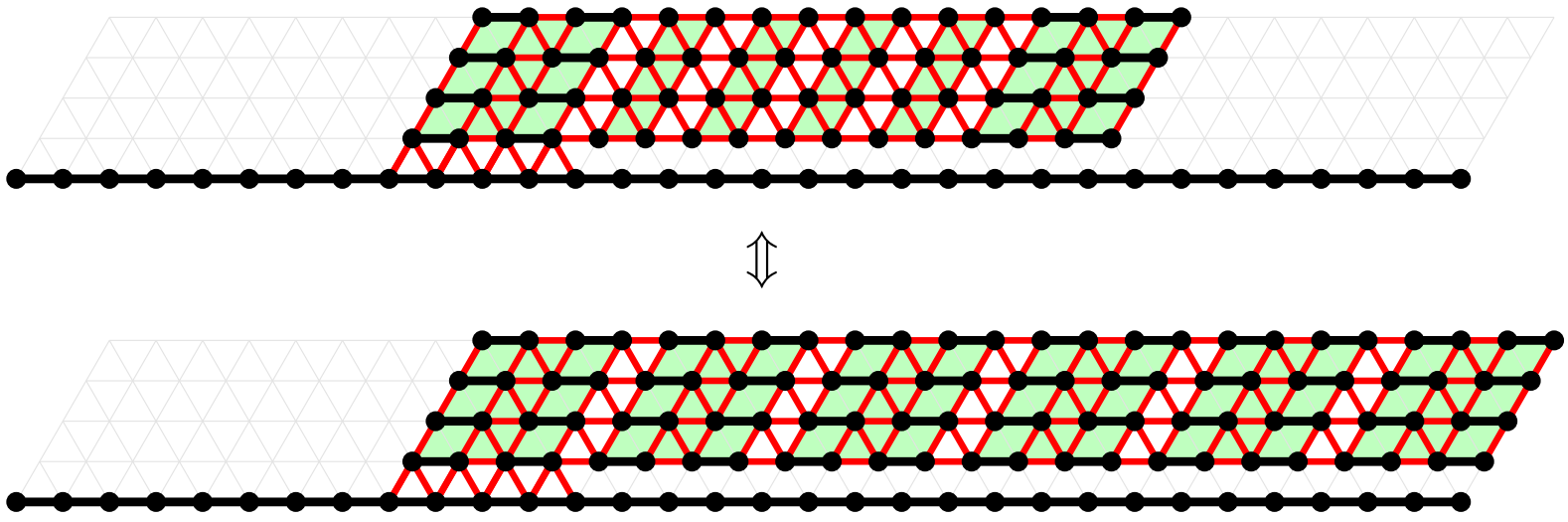
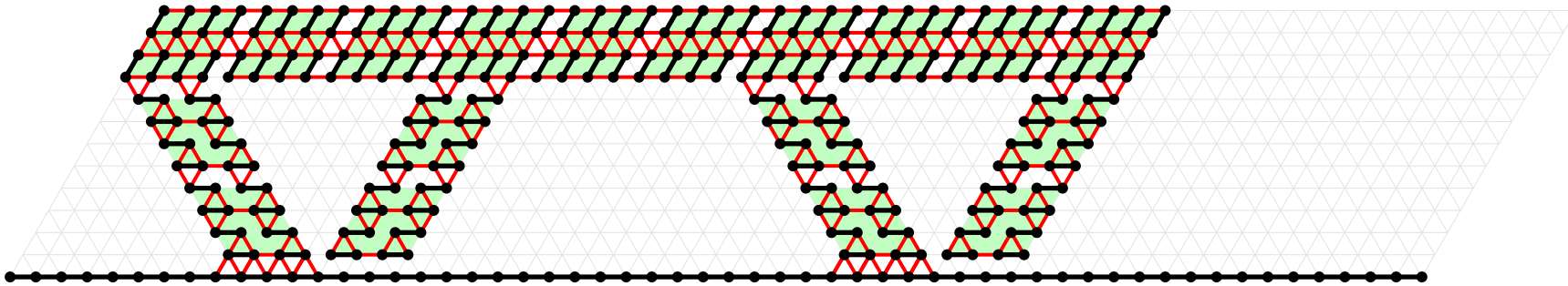
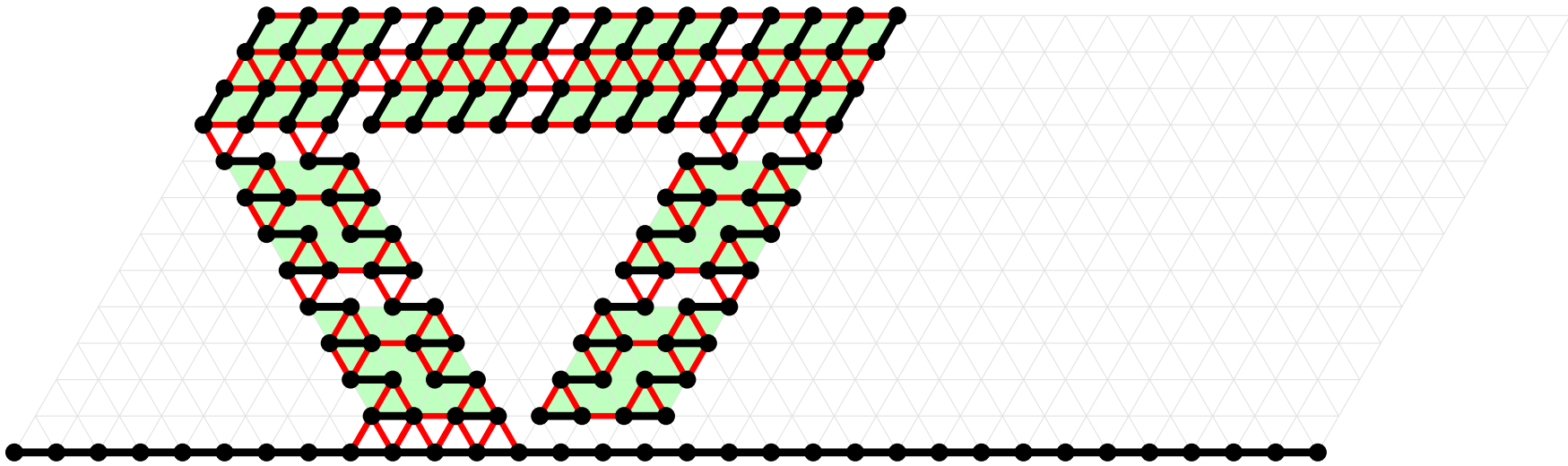


Locomotion: Walking Millipede Structure



Locomotion: Walking Millipede Structure



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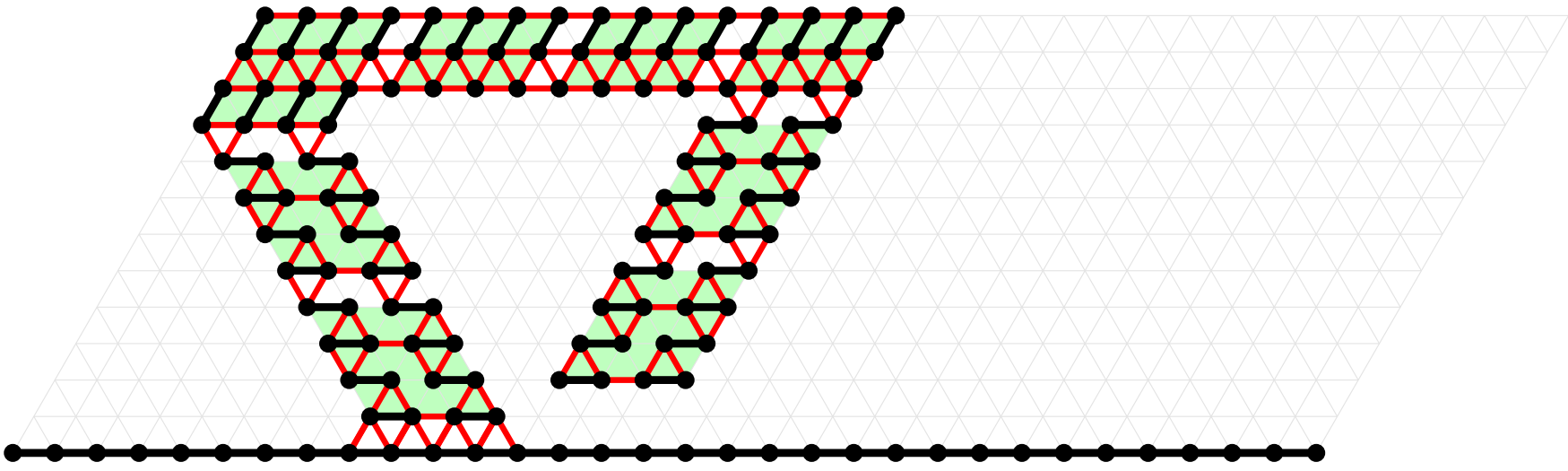

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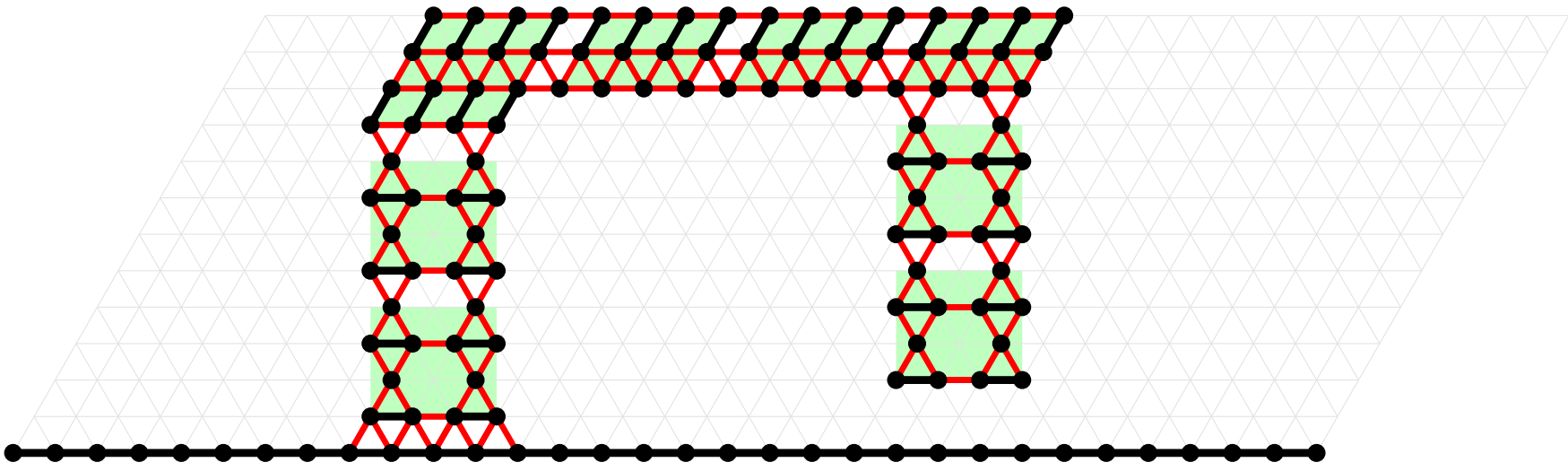

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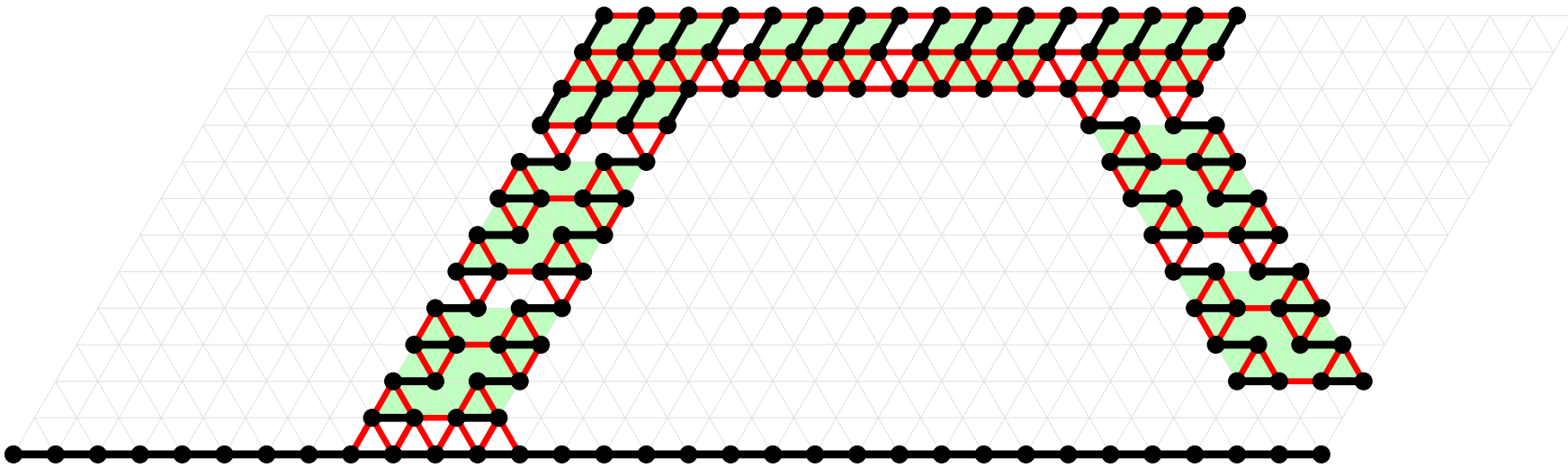

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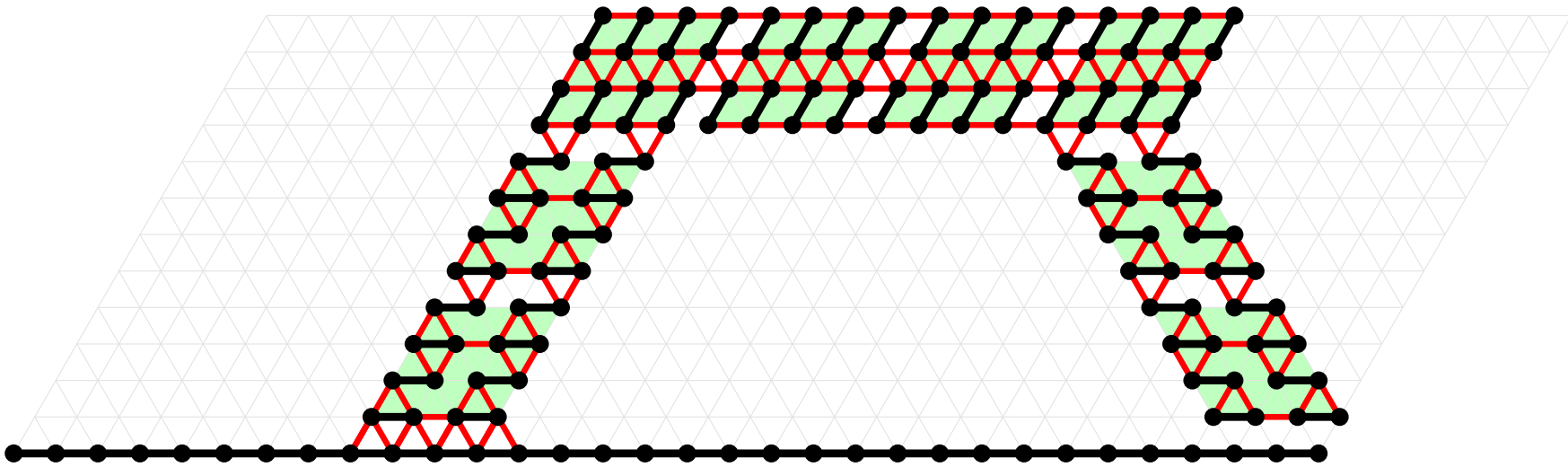
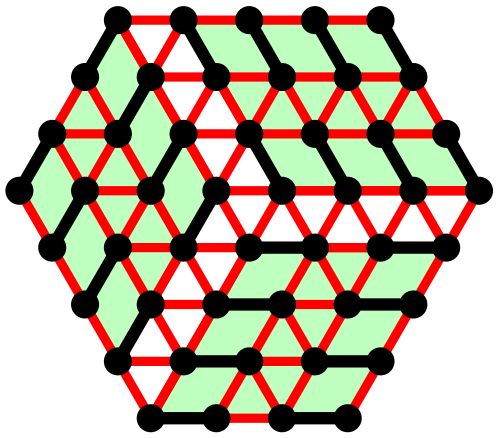
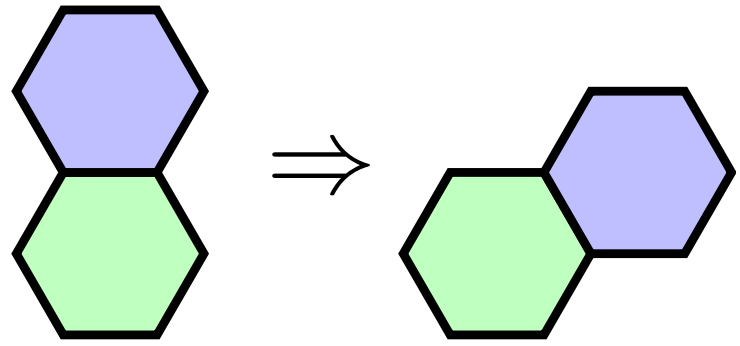


Hexagonal Meta-Modules





Thank you for your attention

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