

# Mechanical Comparison of Arrangement Strategies for Topological Interlocking Assemblies

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# Topological Interlocking

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### Here:

- planar topological interlocking assemblies, i.e. between two parallel planes in 3D-space,
- use perimeter as the frame,
- only copies of the same block differently arranged.

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$$\begin{aligned} B_1 := & \{ \{v_1, v_2\}, \{v_1, v_3\}, \{v_1, v_4\}, \{v_1, v_5\}, \{v_1, v_9\}, \{v_2, v_3\}, \{v_2, v_5\}, \\ & \{v_2, v_6\}, \{v_2, v_7\}, \{v_3, v_4\}, \{v_3, v_7\}, \{v_4, v_7\}, \{v_4, v_8\}, \{v_4, v_9\}, \\ & \{v_5, v_6\}, \{v_5, v_7\}, \{v_5, v_9\}, \{v_6, v_7\}, \{v_7, v_8\}, \{v_7, v_9\}, \{v_8, v_9\} \}, \end{aligned}$$



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and triangular faces

$$B_2 := \{\{v_1, v_2, v_3\}, \{v_1, v_2, v_5\}, \{v_1, v_3, v_4\}, \{v_1, v_4, v_9\}, \{v_1, v_5, v_9\}, \\ \{v_2, v_3, v_7\}, \{v_2, v_5, v_6\}, \{v_2, v_6, v_7\}, \{v_3, v_4, v_7\}, \{v_4, v_7, v_8\}, \\ \{v_4, v_8, v_9\}, \{v_5, v_6, v_7\}, \{v_5, v_7, v_9\}, \{v_7, v_8, v_9\}\}.$$

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The Versatile Block is a polyhedron embedded in  $\mathbb{R}^3$ , given by  $B_0, B_1, B_2$  together with coordinates

$$v_1 = (0, 0, 0), v_2 = (1, 1, 0), v_3 = (2, 0, 0),$$

$$v_4 = (1, -1, 0), v_5 = (0, 1, 1), v_6 = (1, 1, 1),$$

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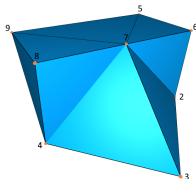
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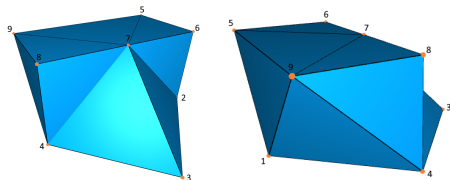
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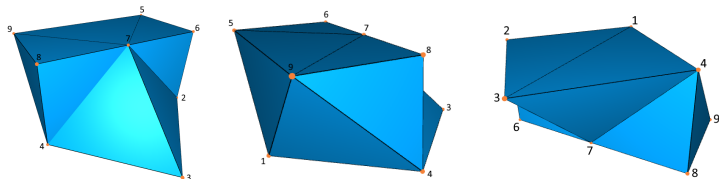
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# Wallpaper Groups

# Planar Assemblies of the Versatile Block

# Finite Element Method



# Problem formulation

# Simulation Setup

# Stresses

# Combinatorial Method

# Combinatorial Results



