# Roombots-CPG, Symmetries and online optimization.

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Midterm presentation

November 3, 2008

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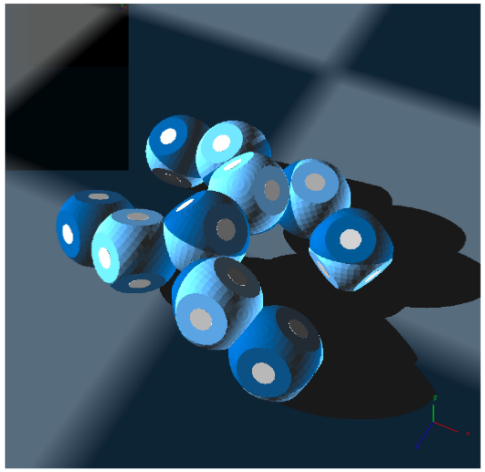
  - add sensor feedback from the roombot to the CPG.
- Lot of previous work done by former student (YaMor host 3.0).

# A Way to Caracterize a Roombot Structure.



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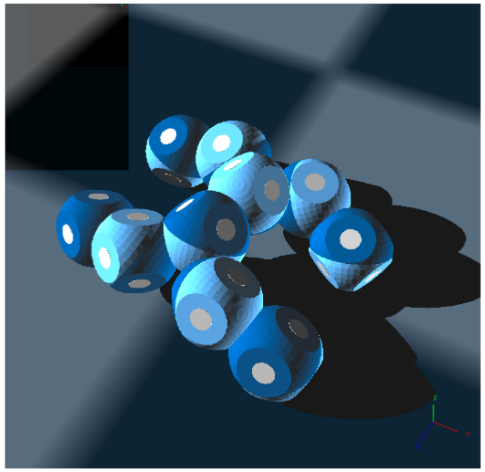

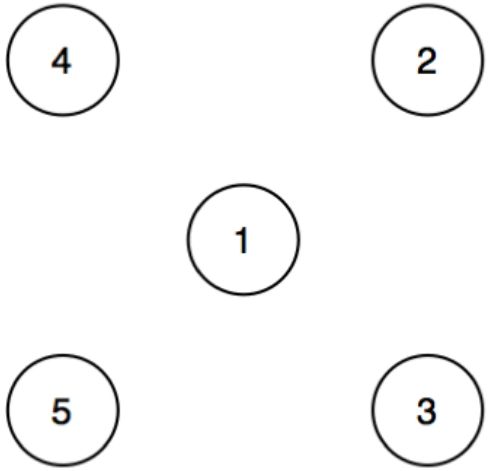


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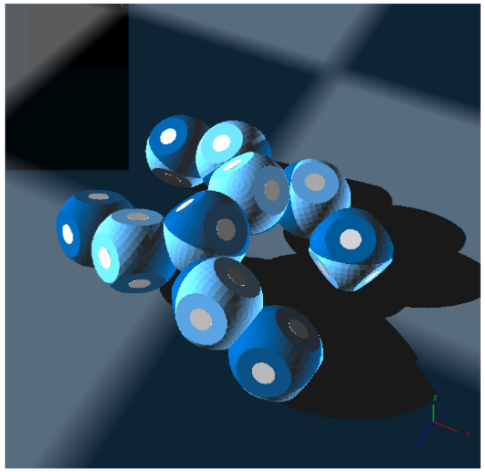

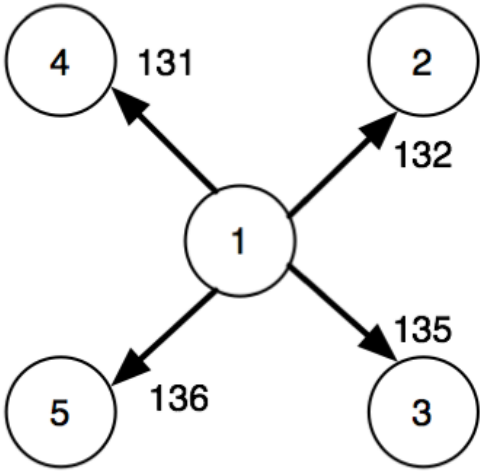


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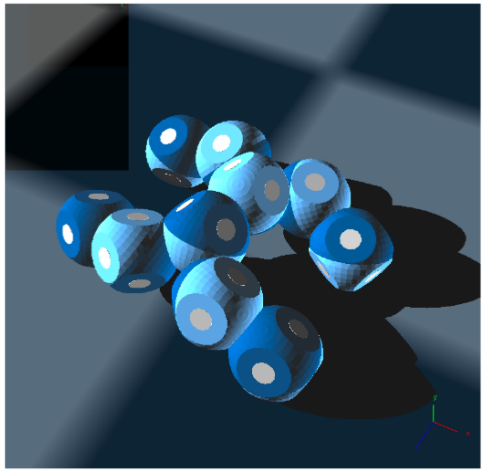

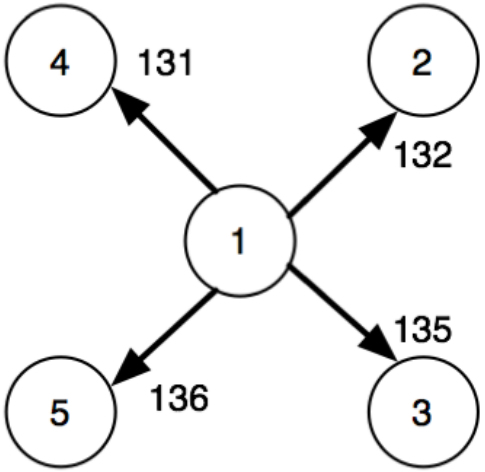


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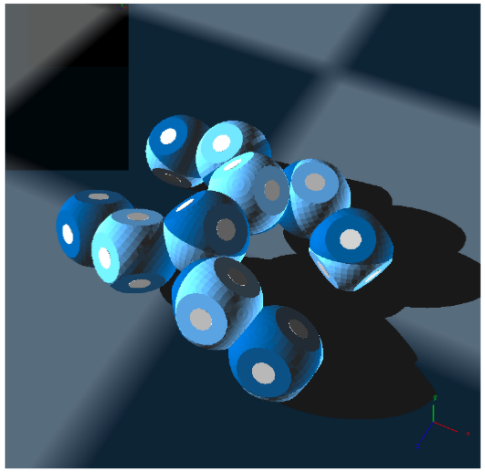

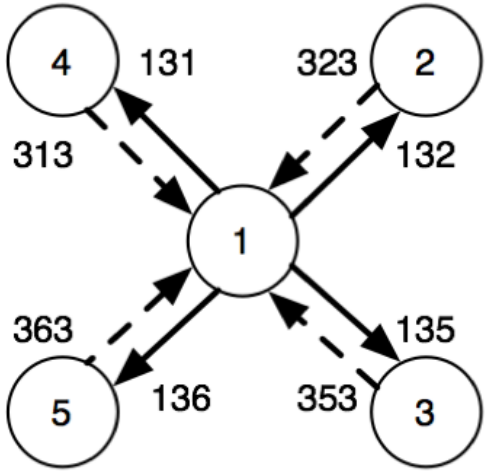


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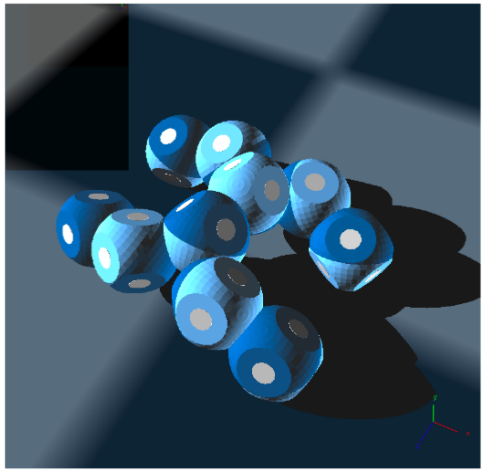

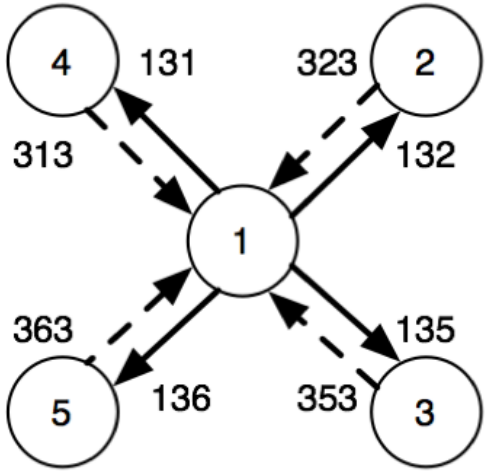


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- We represent the structure as a graph :
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- Different frome Jocelyne's one, since our graph must be servo values independant.

# Analyse the structure.

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- Find a way to detect symmetries in a structure, and then determine the available gait.
- Maybe try to memorize some patterns.

# Online Learning.

- Our goal is to learn a gait by optmization :

$$\max_{\mathbf{X}} f(\mathbf{X}, \alpha) \tag{1}$$

- We don't know a mathematical expression for $f$, but $f$ is:
  - nonlinear.
  - multimodal.

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- Powel's method can be extended to multimodal function :
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  - Boender-Rinnooy-Stougie-Timmer (BRST) algorithm.

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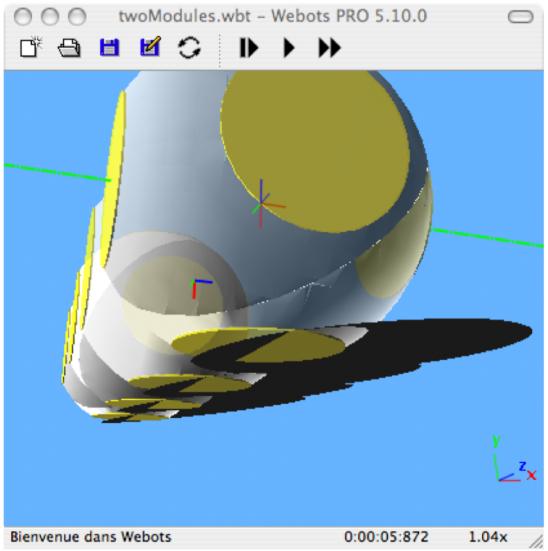
  - done by integrating over more time, but has a cost.
- Idea : mesure the periodicity of the function :

$$f(X) = \frac{s(t_{end}) - s(t_{deb})}{t_{end} - t_{deb}} - K. \int_{t_{deb}+T}^{t_{end}} (\dot{s}(t) - \dot{s}(t-T))^2 \, dt \tag{2}$$

# Modelisation of the contacts.

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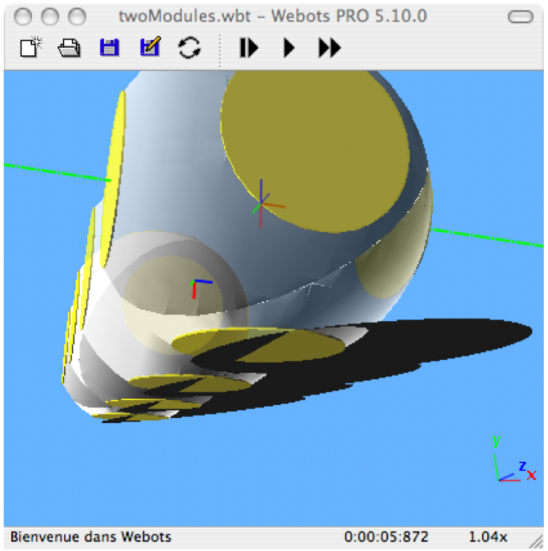


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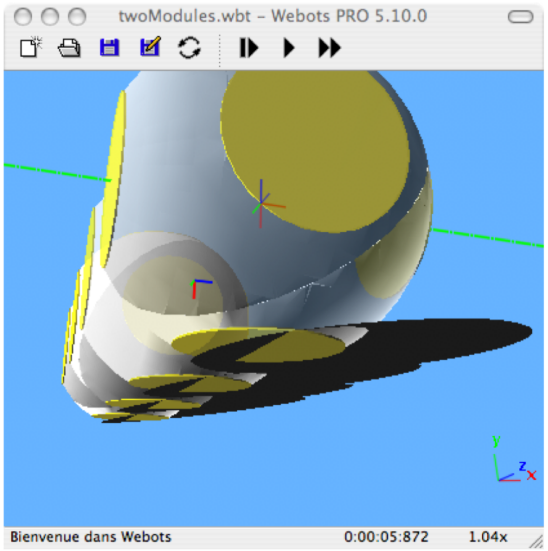


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Problem :
Difficulty to implement it in webots.

# Detection colision with a plane.

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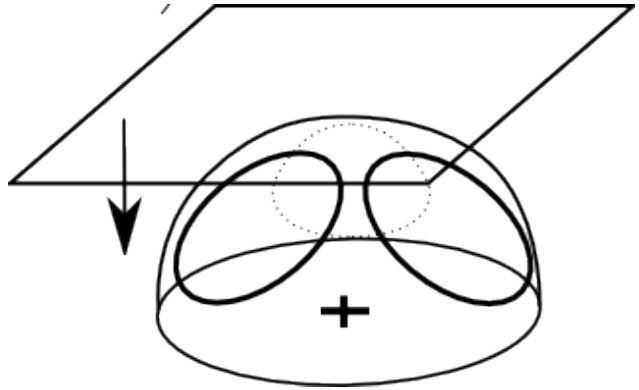

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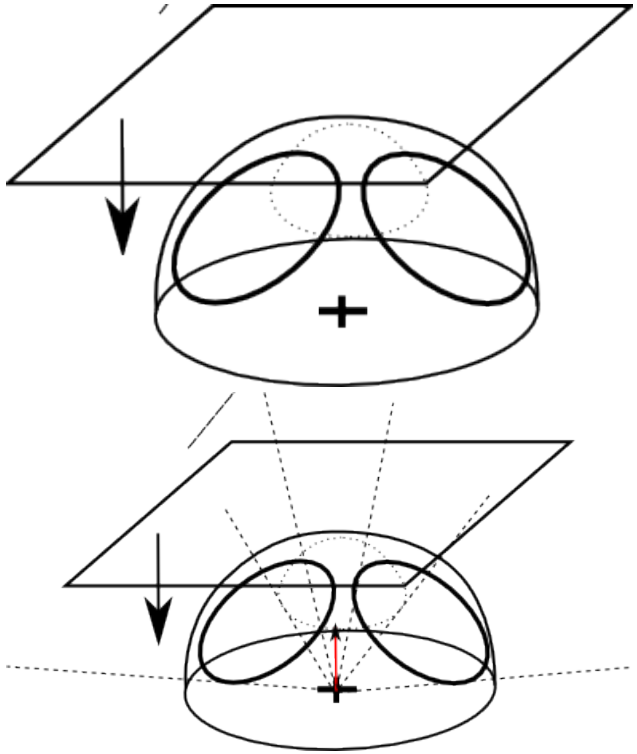

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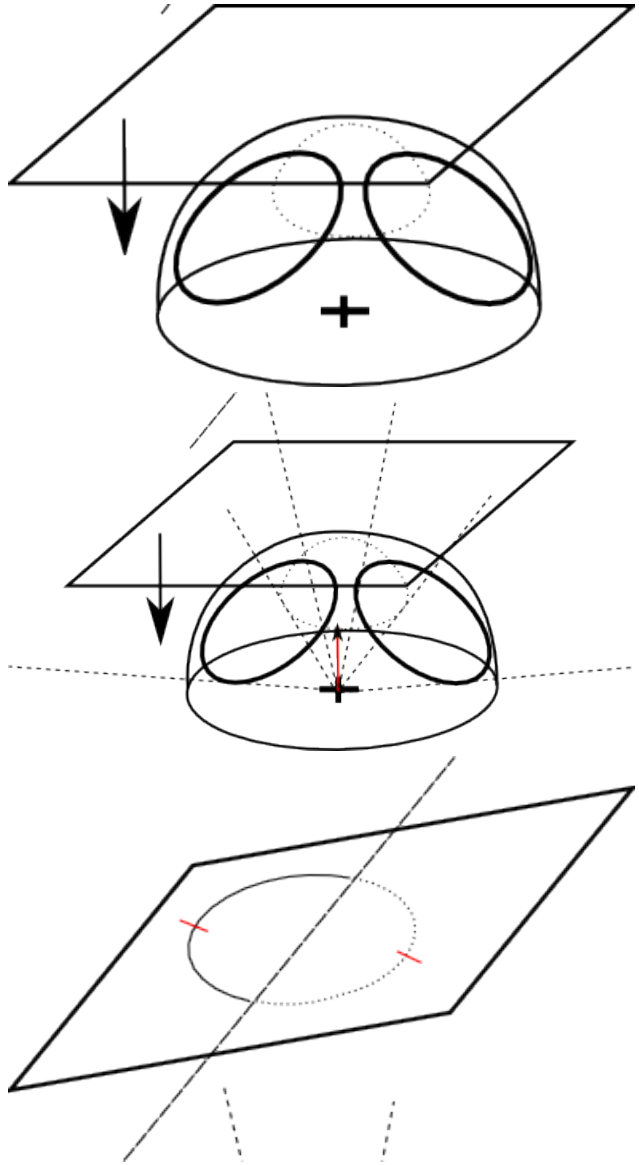

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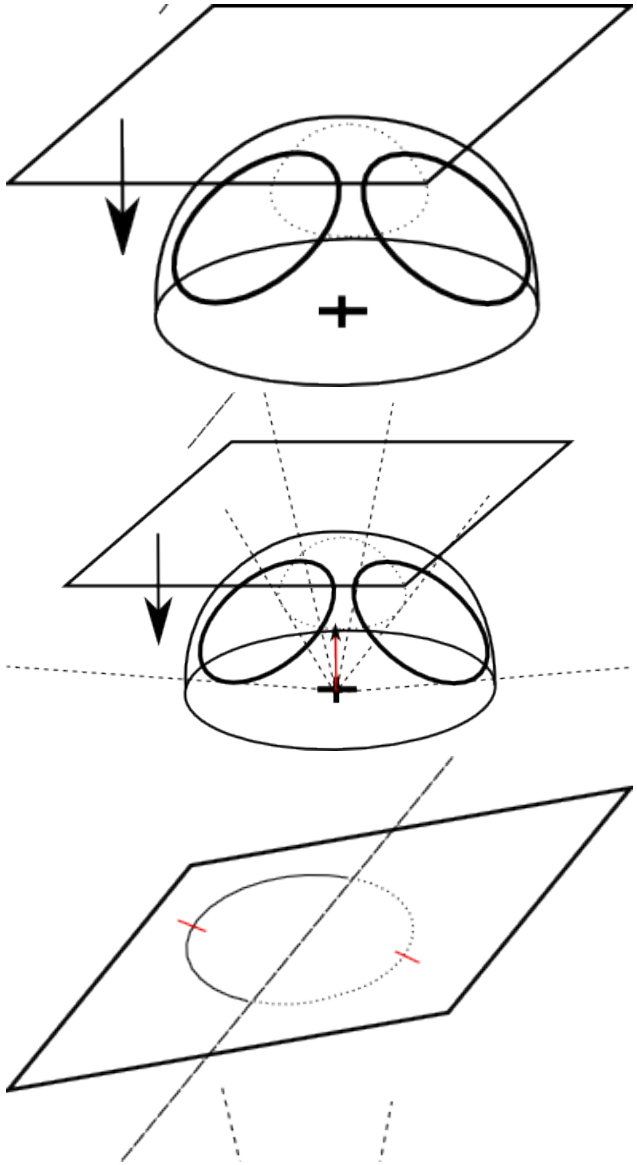

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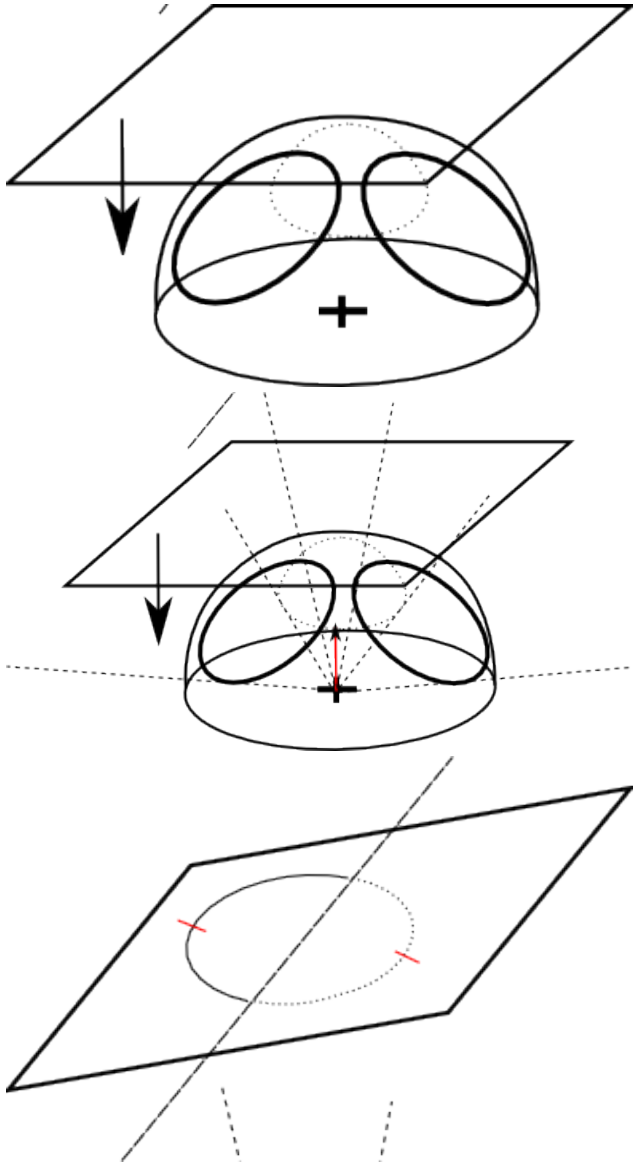
    2. If the highest is over the plane, then we just send back the deepest point of the circle.



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- Attemp some first result with Powell algorithm and simple CPG this week.

# Questions ?