Aide à la conception d'opérations topologiques par inférence

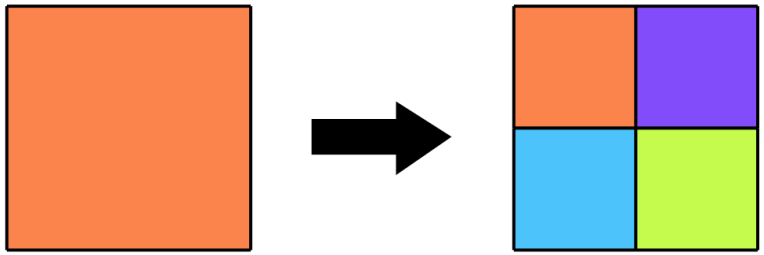
Journées du GTMG 2021

Romain Pascual[1], Hakim Belhaouari[2], Agnès Arnould[2] et Pascale Le Gall[1]

[1] Laboratoire MICS, [2] Laboratoire XLIM

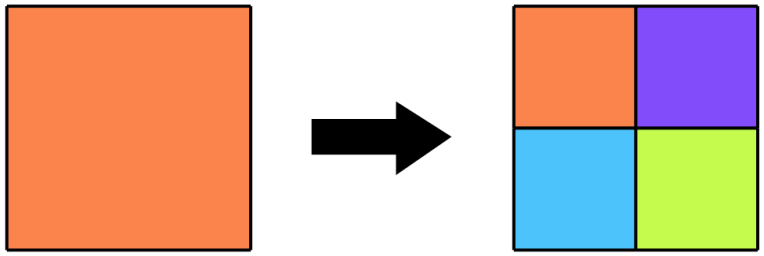
18-19 Mars 2021

Motivation

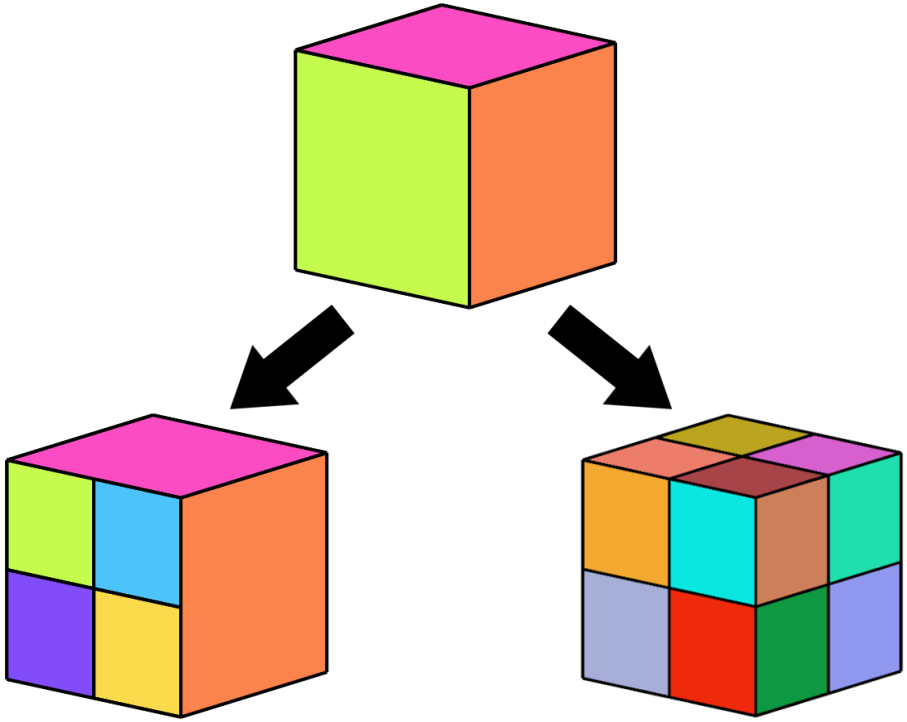


- Subdivision d'une face

Motivation

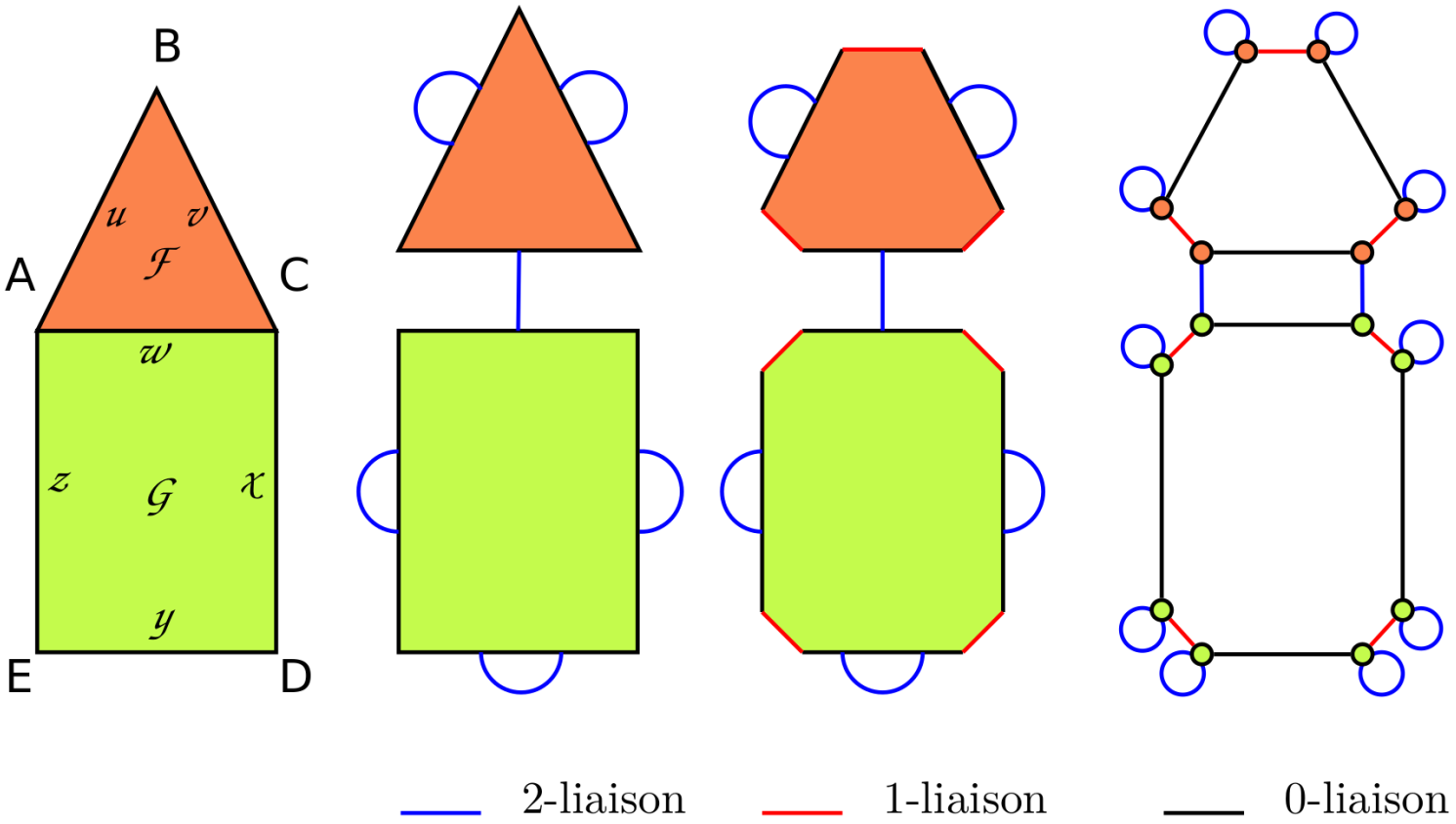


- Subdivision d'une face

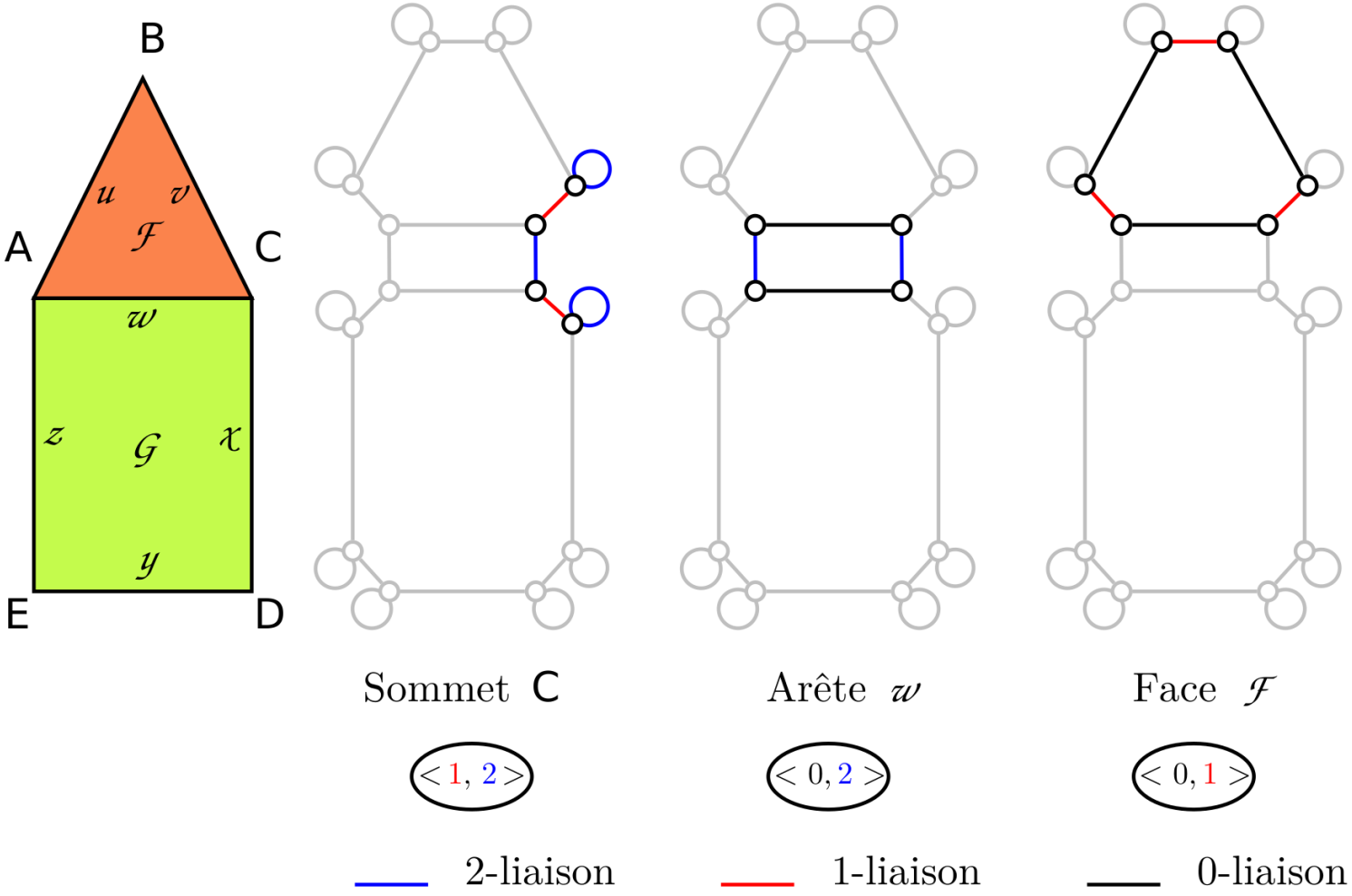


- Comment appliquer l'opération sur un cube ?

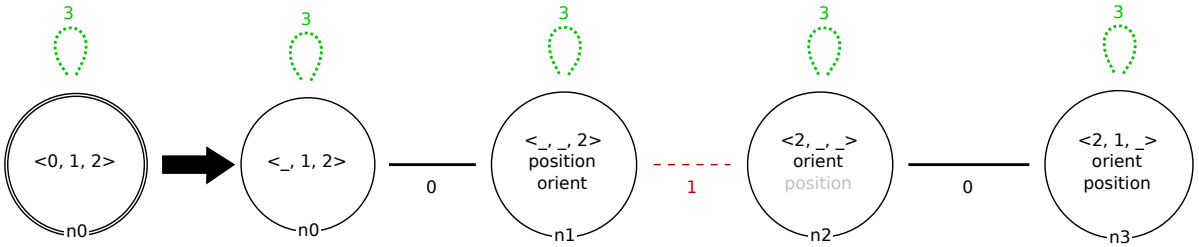
Cartes généralisées ou G-cartes [Lie89, Lie91]

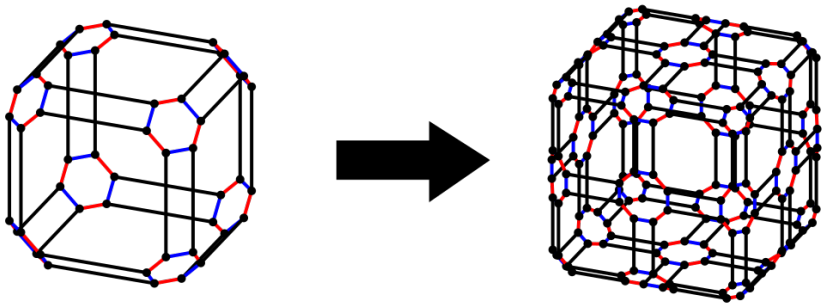


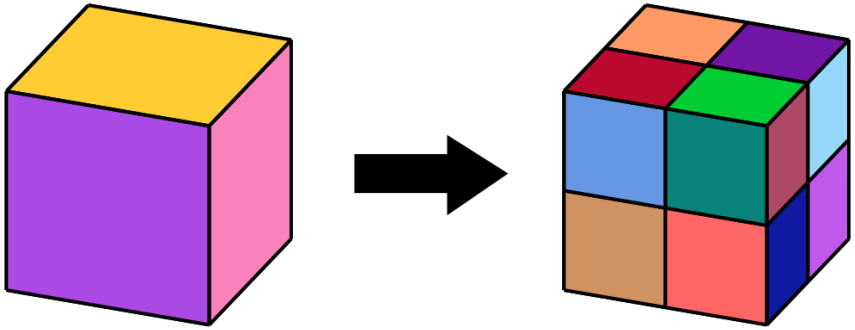
Orbites


B
A
C
E
D
u
v
$\mathcal{F}$
w
z
$\mathcal{G}$
x
y
Sommet C
Arête w
Face $\mathcal{F}$
$< 1, 2 >$
$< 0, 2 >$
$< 0, 1 >$
2-liaison
1-liaison
0-liaison

Opérations de modélisation sous forme de règles





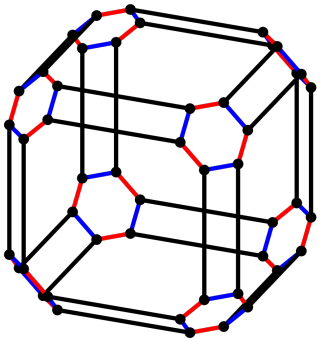


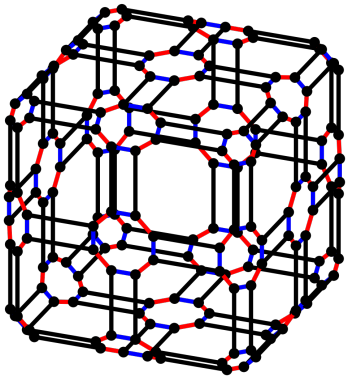
- Schéma de règles Jerboa [BALGB14]
- Règle sur la structure topologique
- Opération correspondante

Objectif de l'algorithme

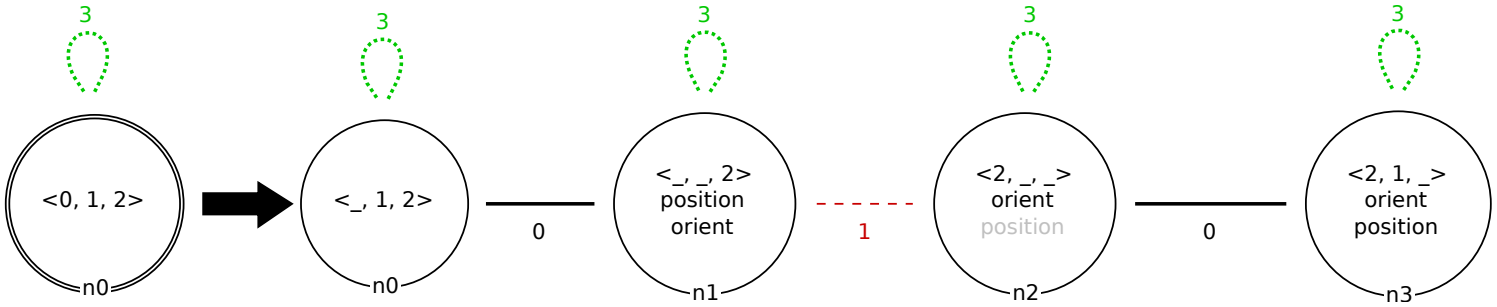
Construction de schémas de règles à partir d'un objet avant et après modification.

- Entrée : G-carte avant et G-carte après.





- Sortie : Schéma(s) de règles pour l'opération correspondante.



Fonctionnement de l'algorithme

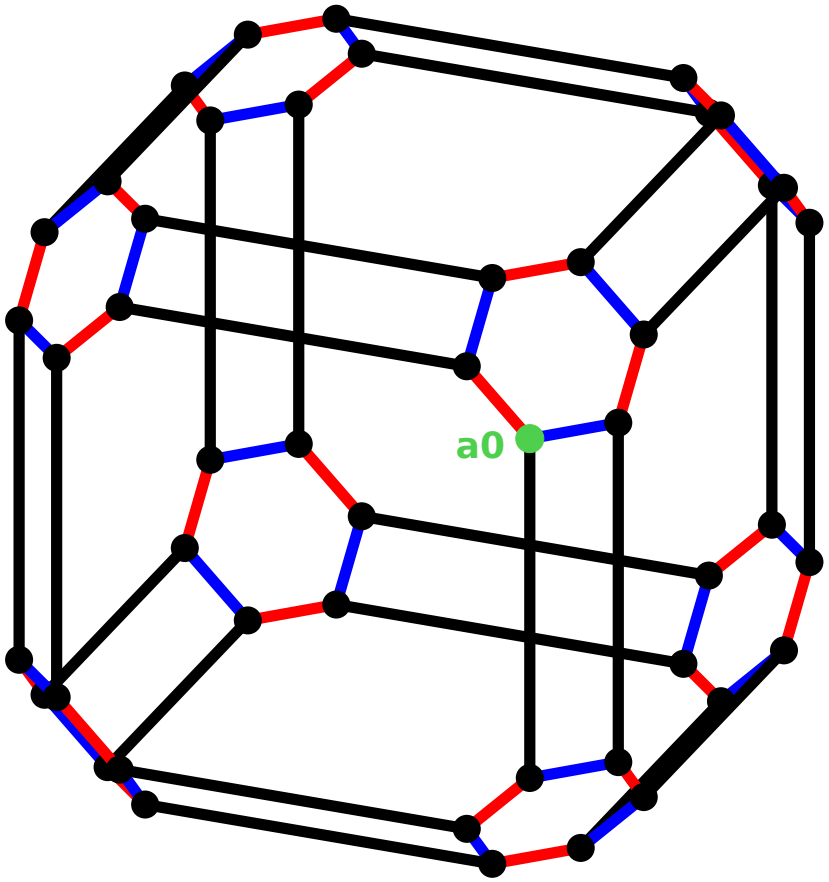
En plus des instances avant et après, on choisit un brin de la G-carte avant et une orbite.

Parcours de la G-carte

Alternance de deux étapes :

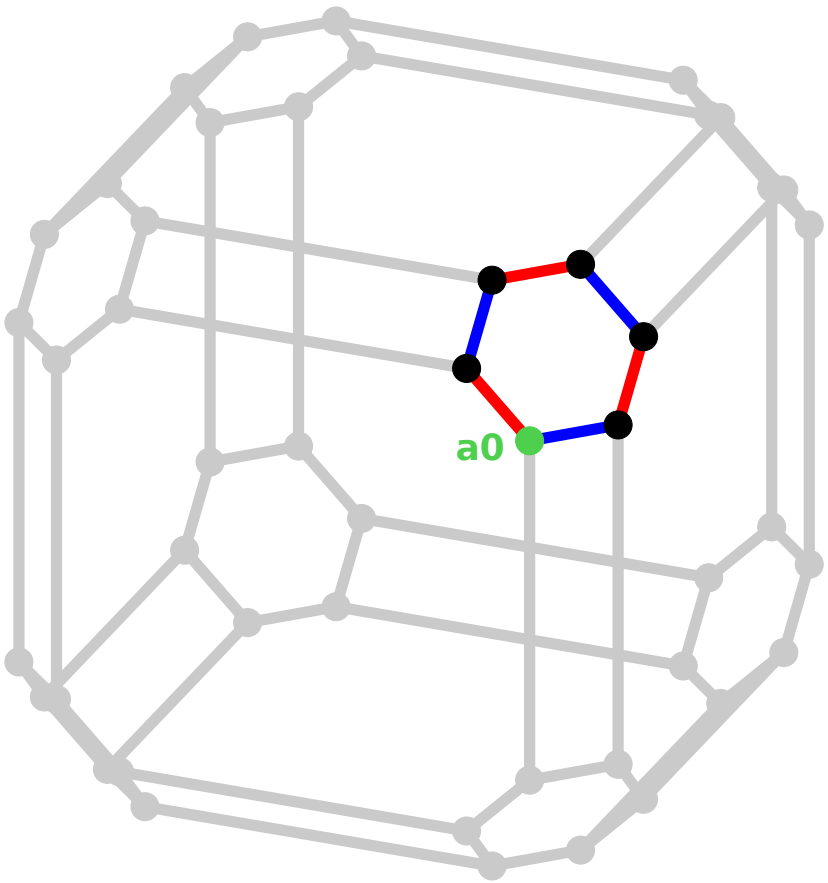
- Constuction d'un nœud,
- Extension des arcs.

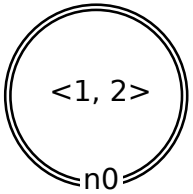
▶ Illustration sur le motif gauche (instance "avant") avec l'orbite $\langle 1, 2 \rangle$.



Détails de l'algorithme

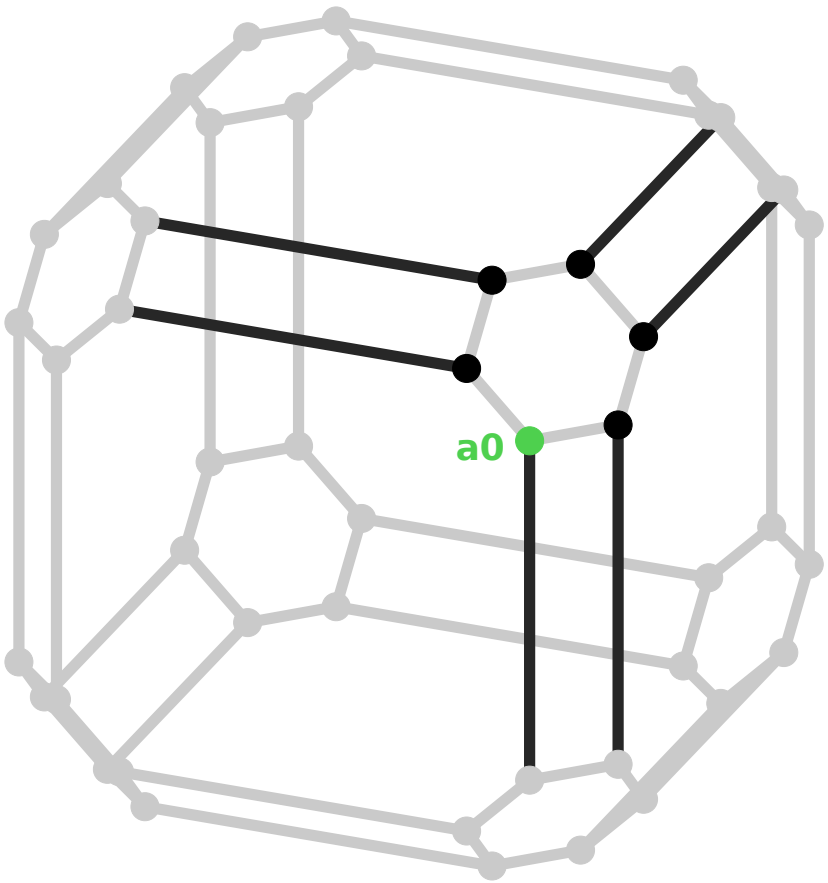
Constuction d'un nœud, cas de l'ancre avec l'orbite $\langle 1, 2 \rangle$.

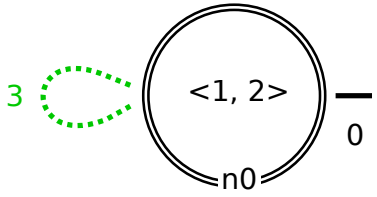




Détails de l'algorithme

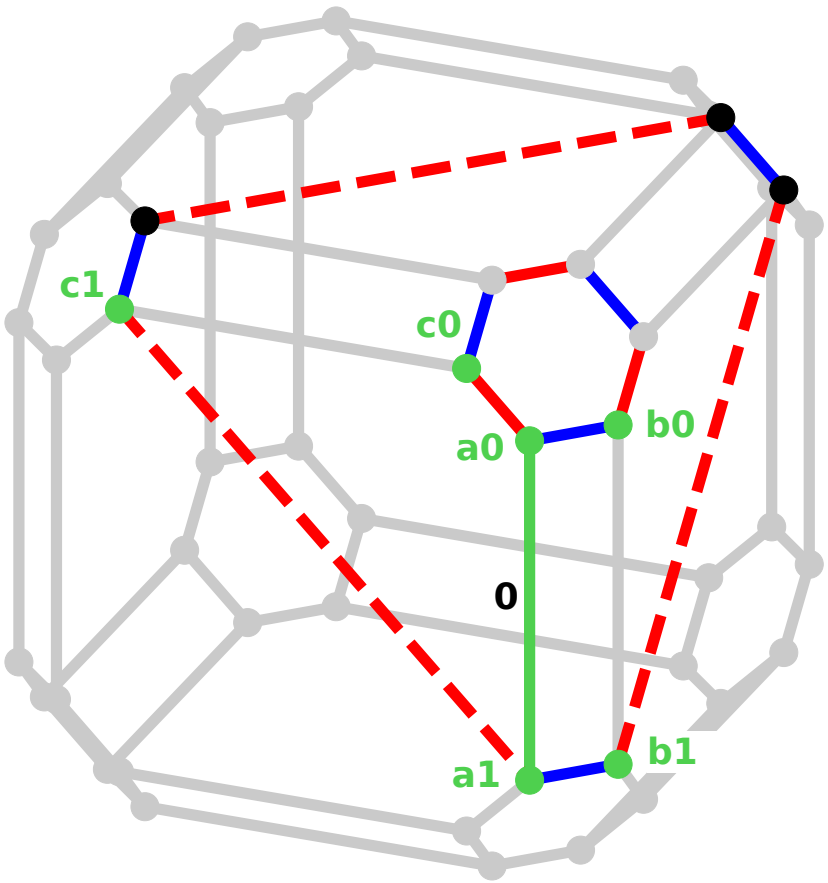
Extension des arcs.

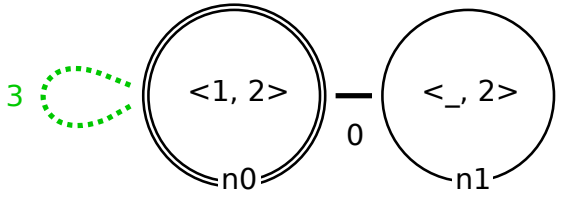




Détails de l'algorithme

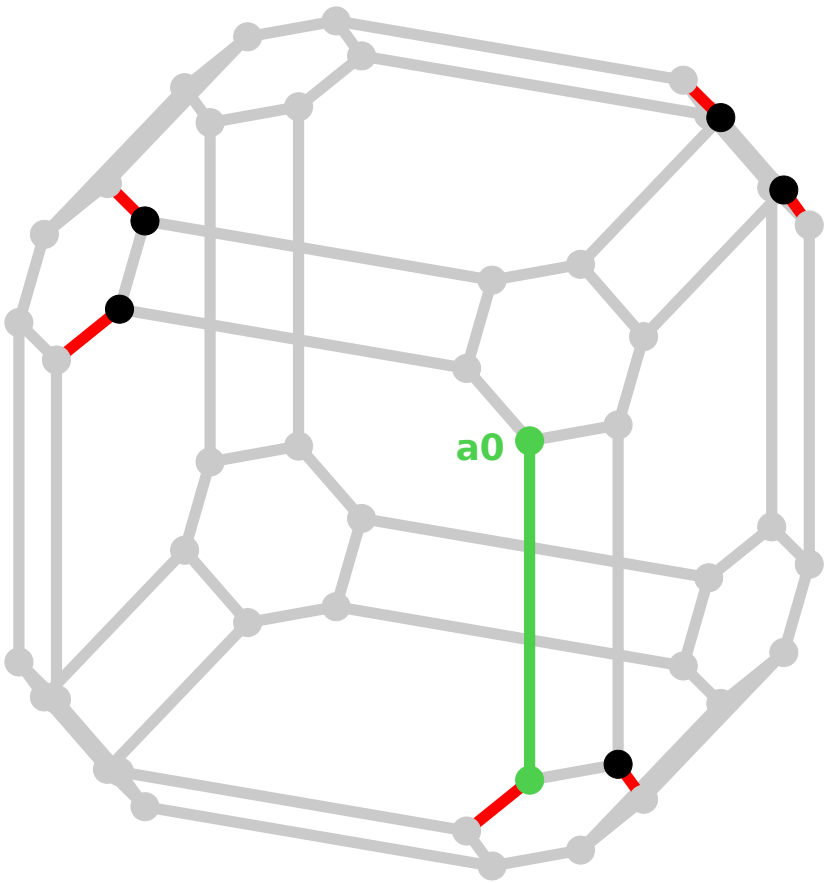
Constuction d'un nœud.

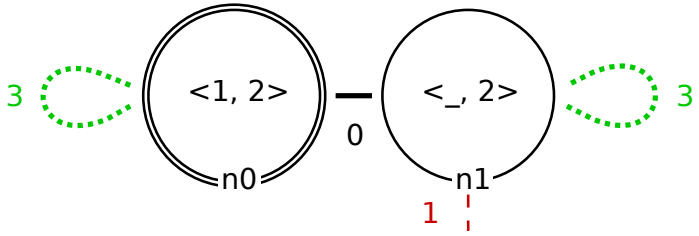




Détails de l'algorithme

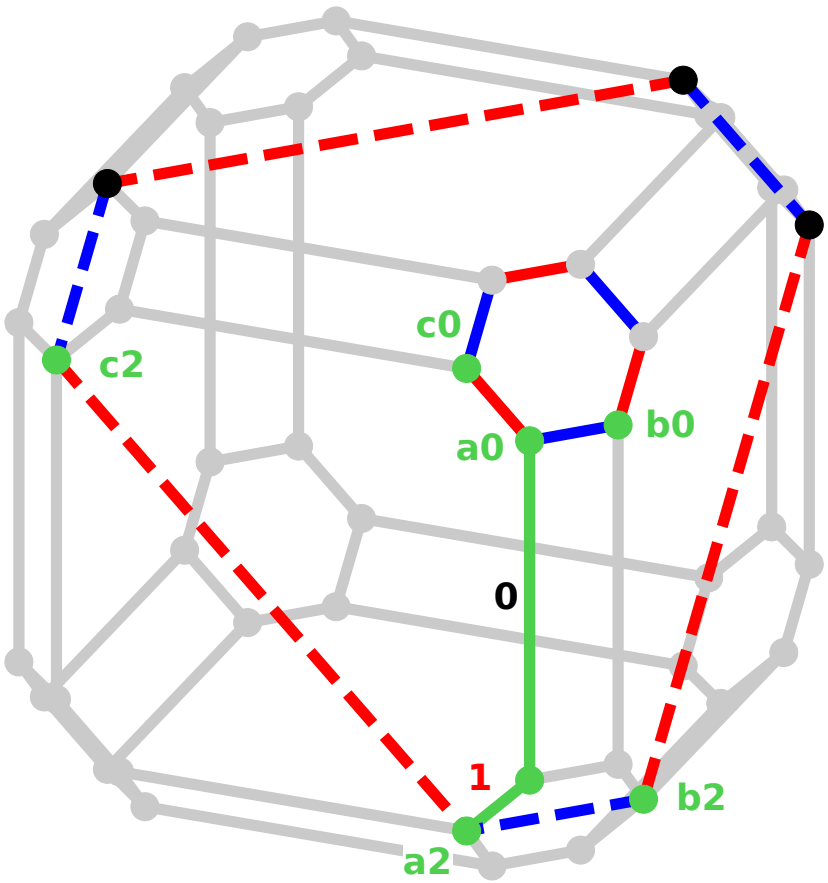
Extension des arcs.

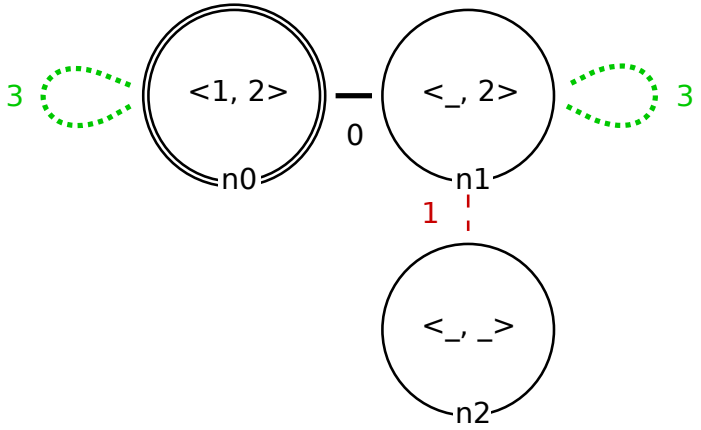




Détails de l'algorithme

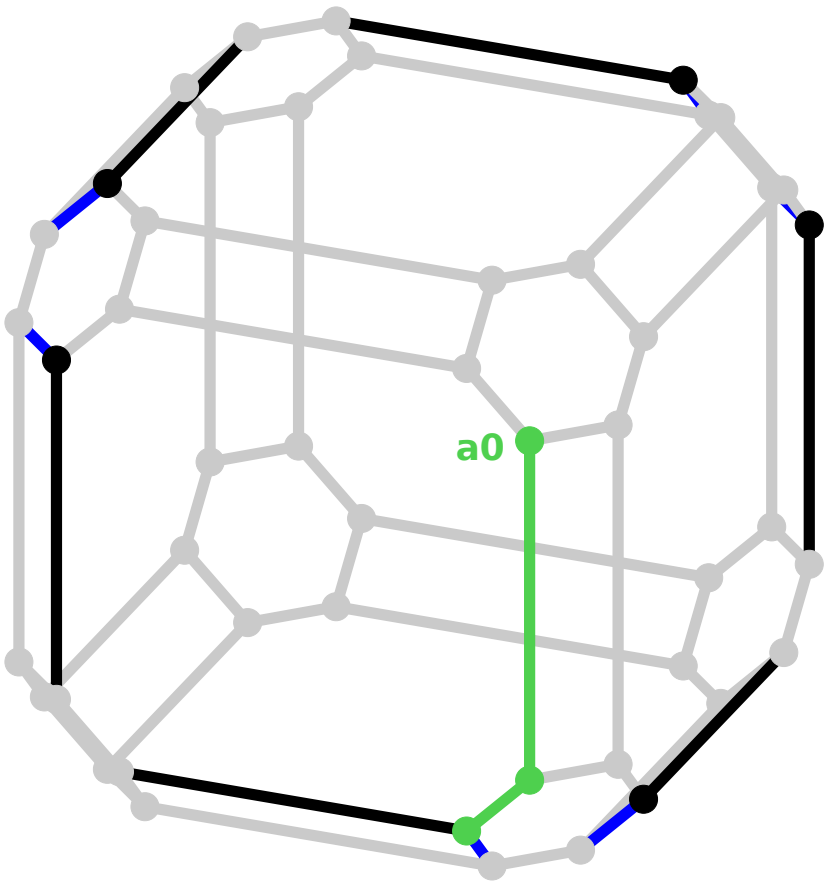
Constuction d'un nœud.

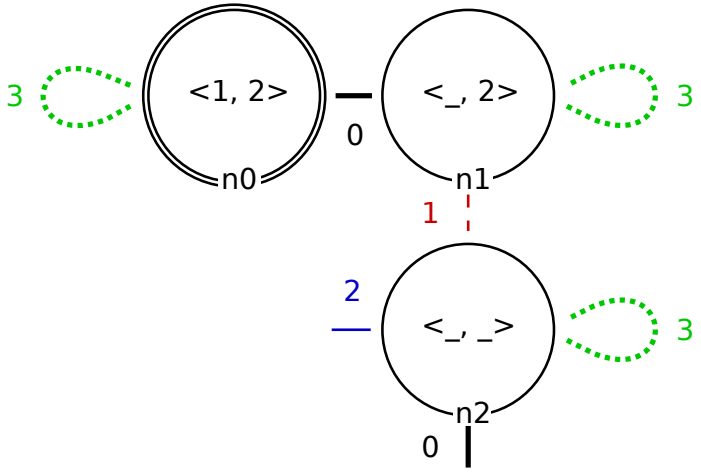




Détails de l'algorithme

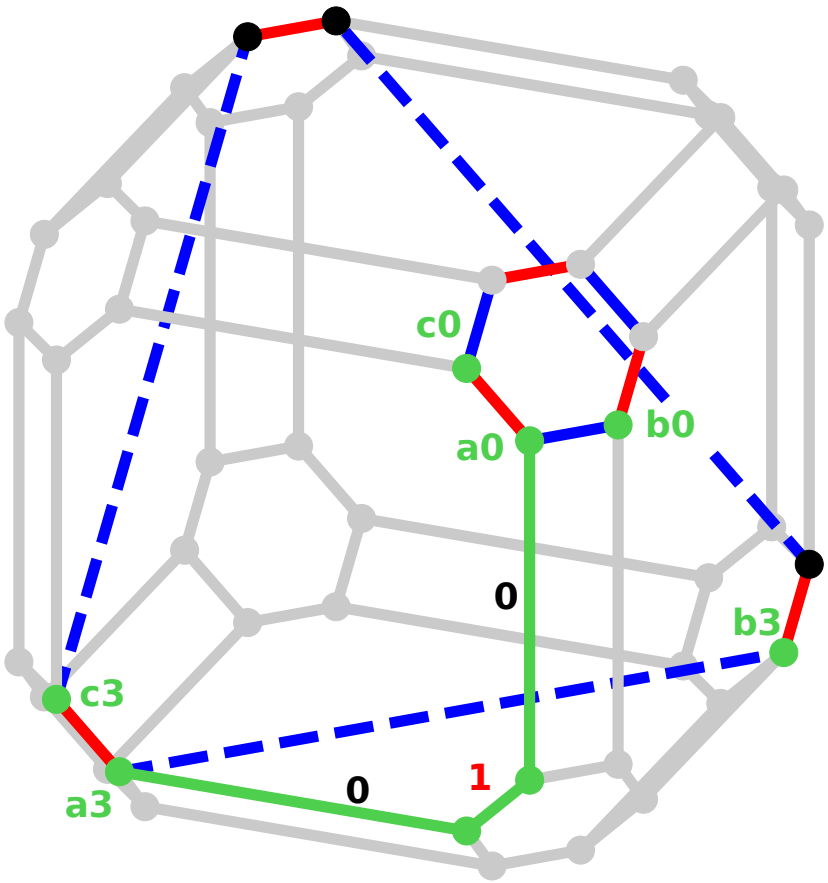
Extension des arcs.

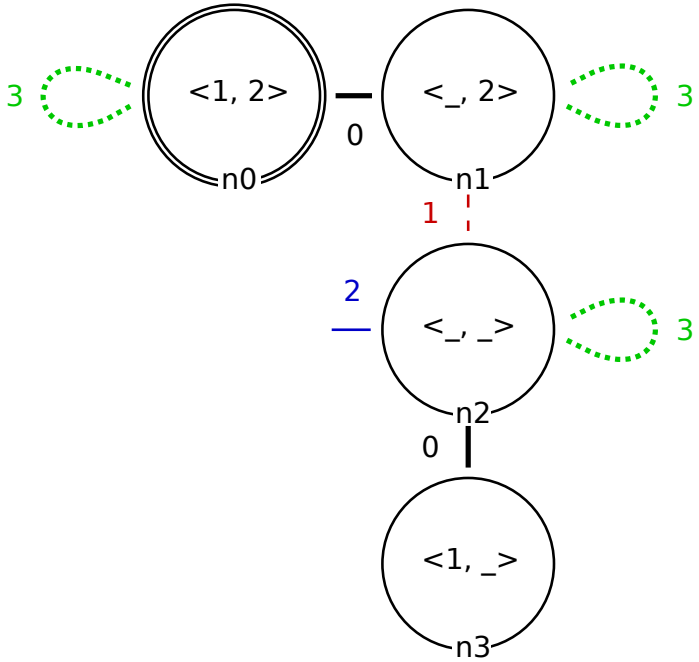




Détails de l'algorithme

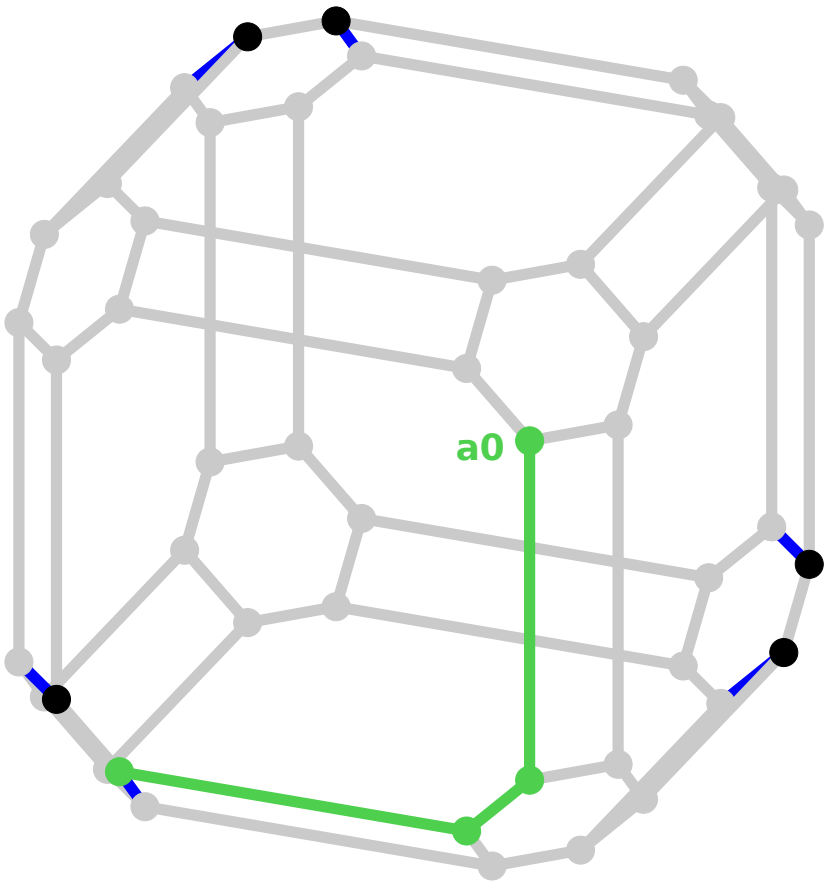
Constuction d'un nœud.

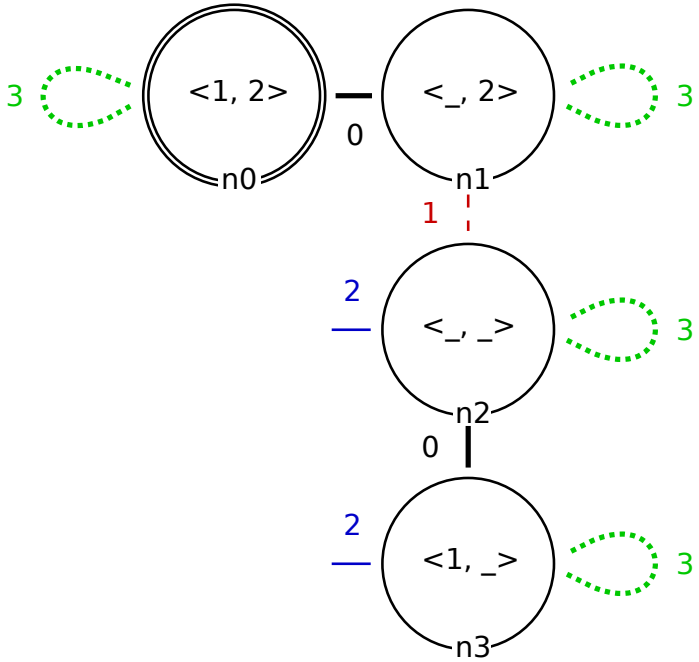




Détails de l'algorithme

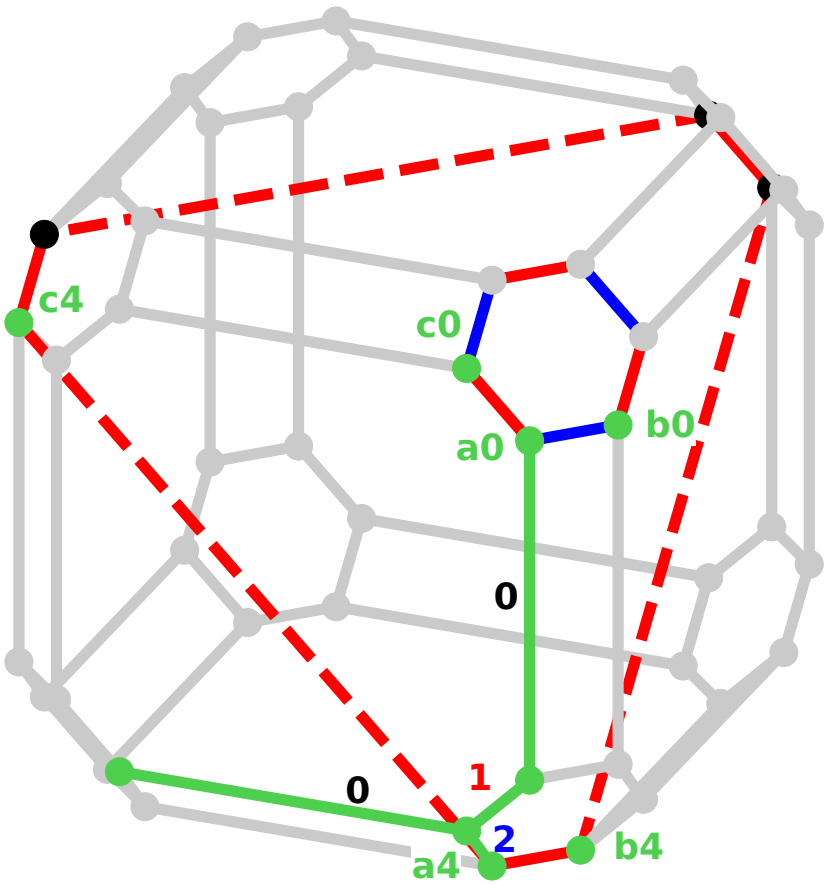
Extension des arcs.

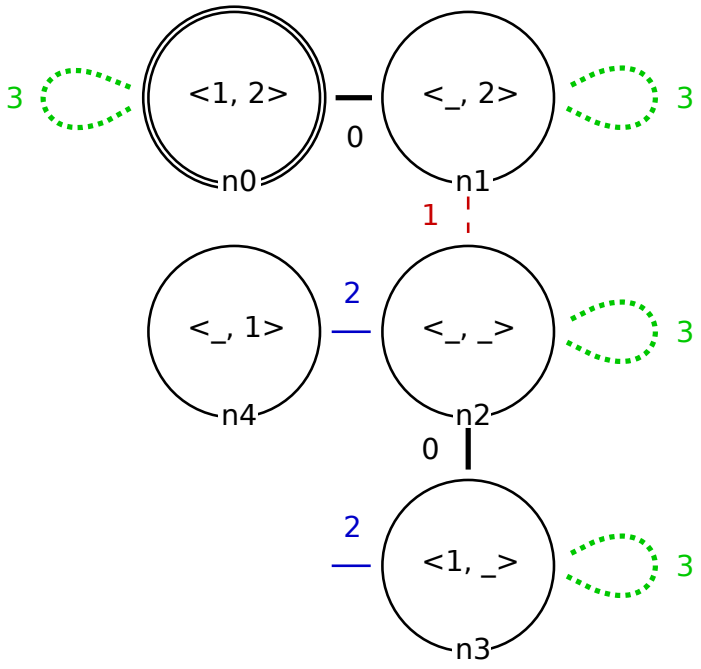




Détails de l'algorithme

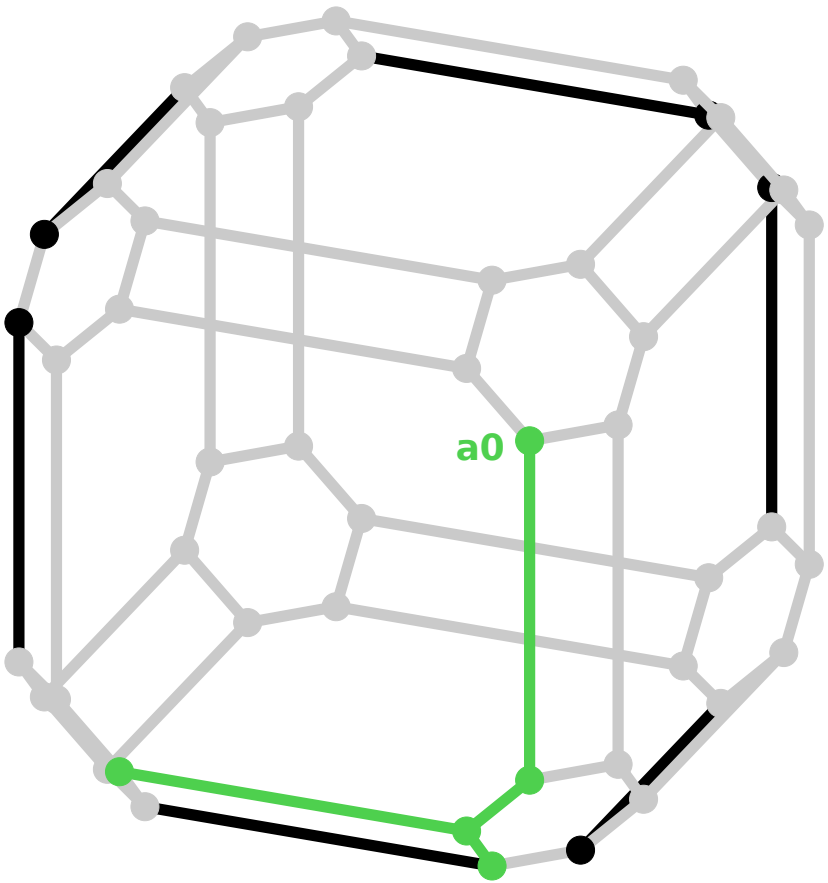
Constuction d'un nœud.

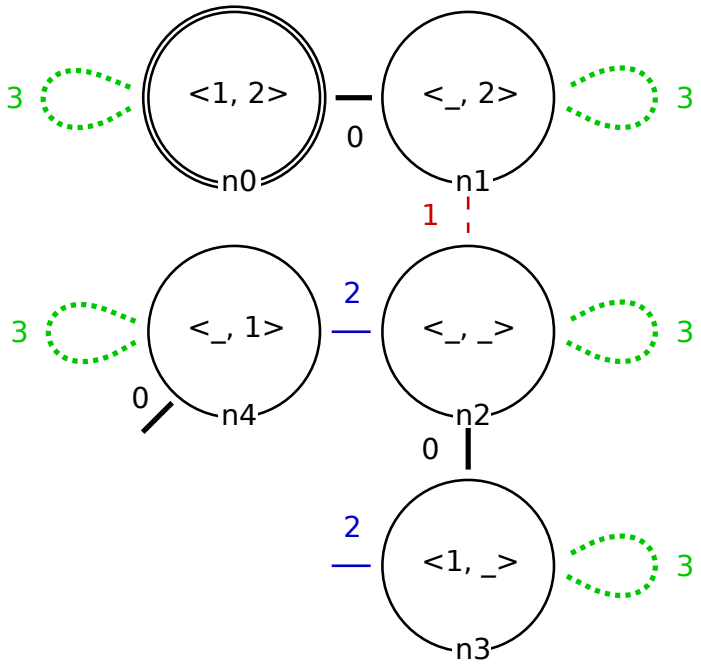




Détails de l'algorithme

Extension des arcs.





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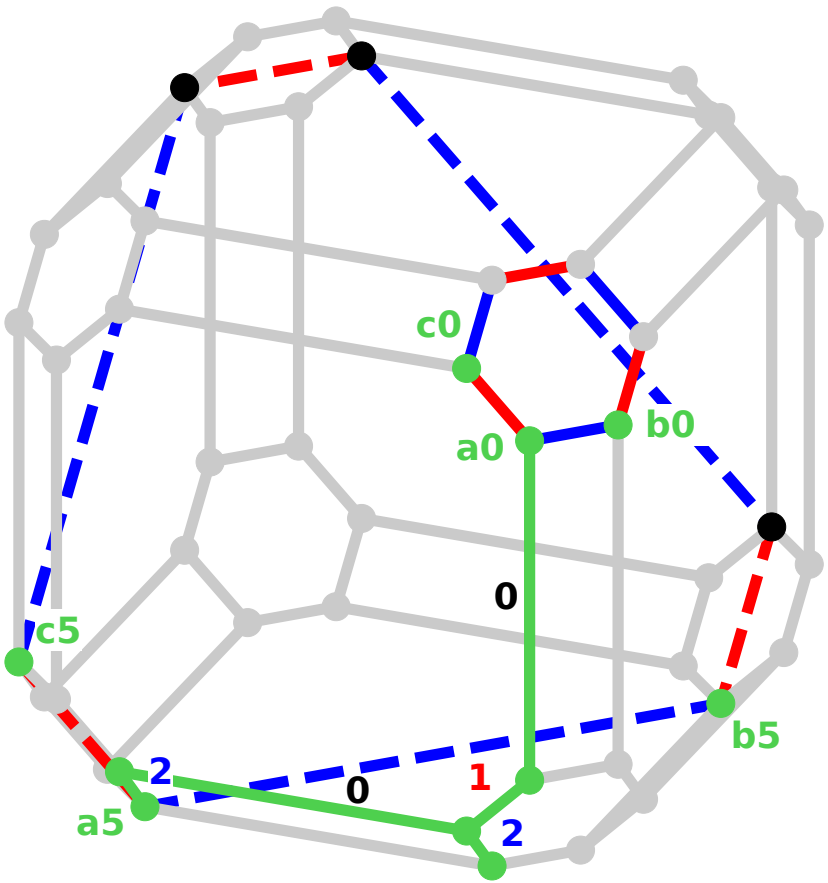
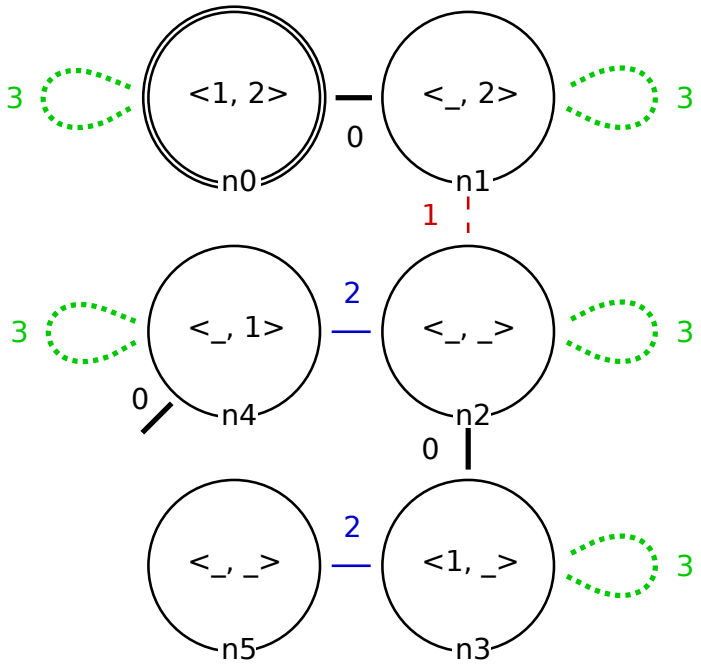
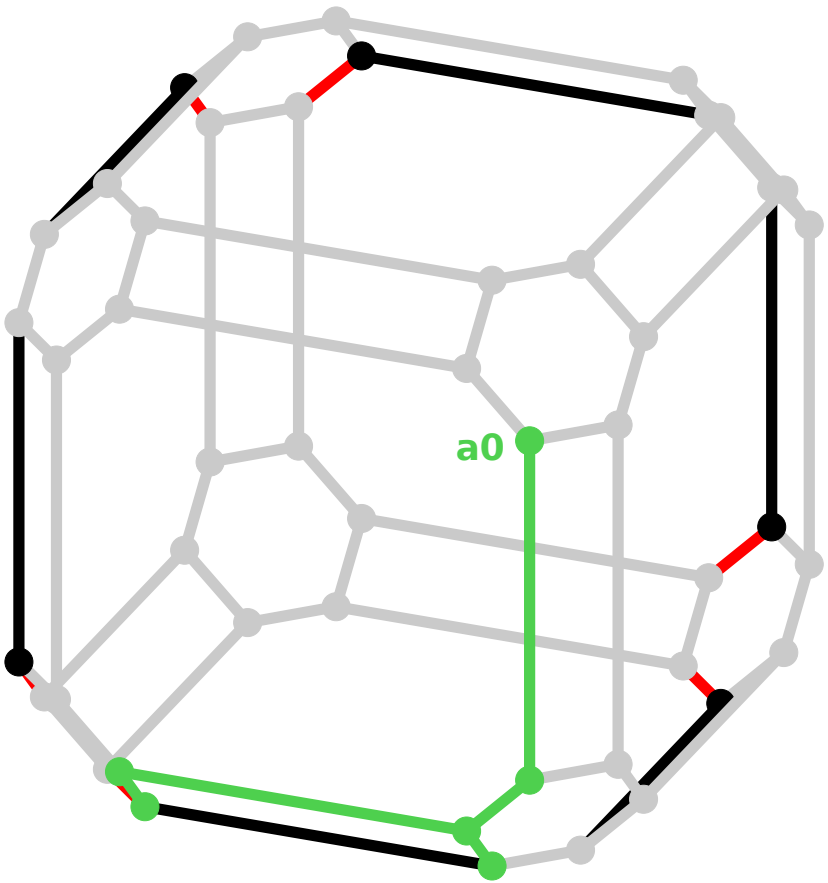
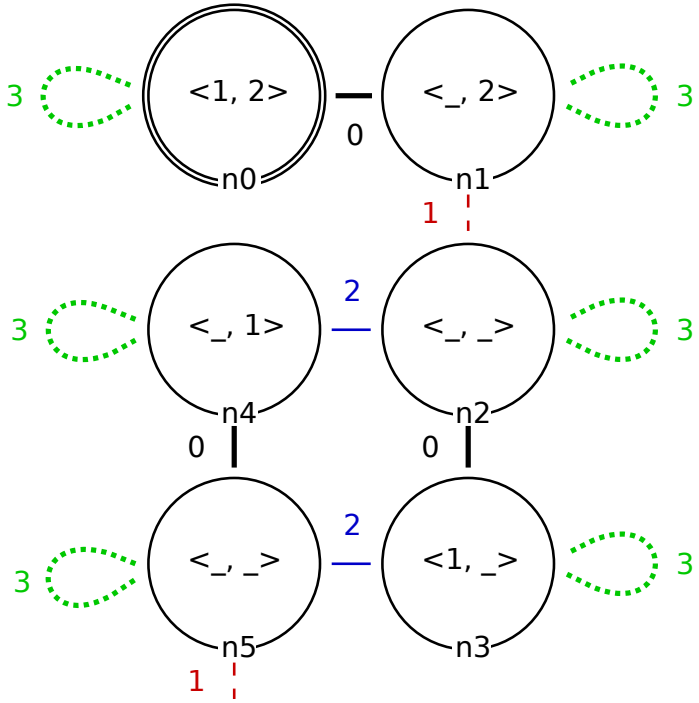




Détails de l'algorithme

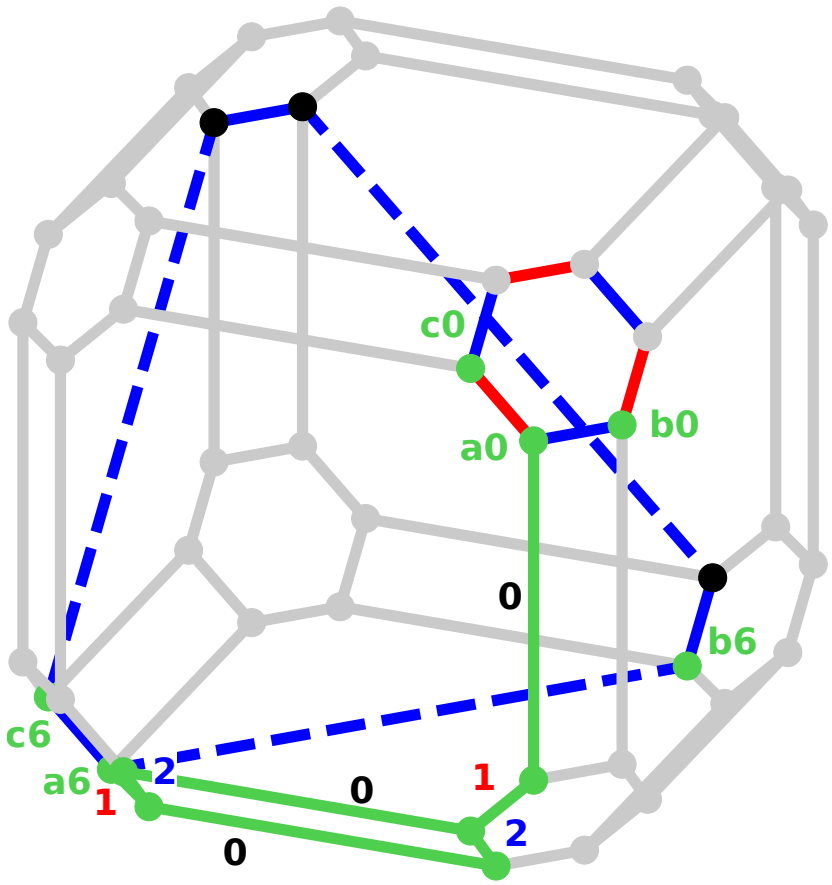
Extension des arcs.

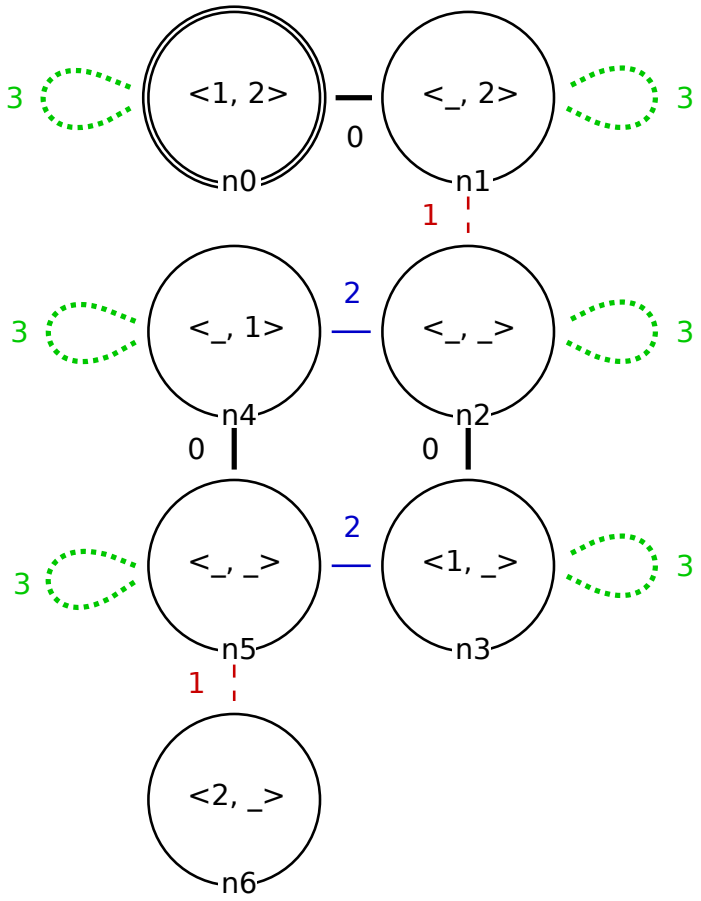




Détails de l'algorithme

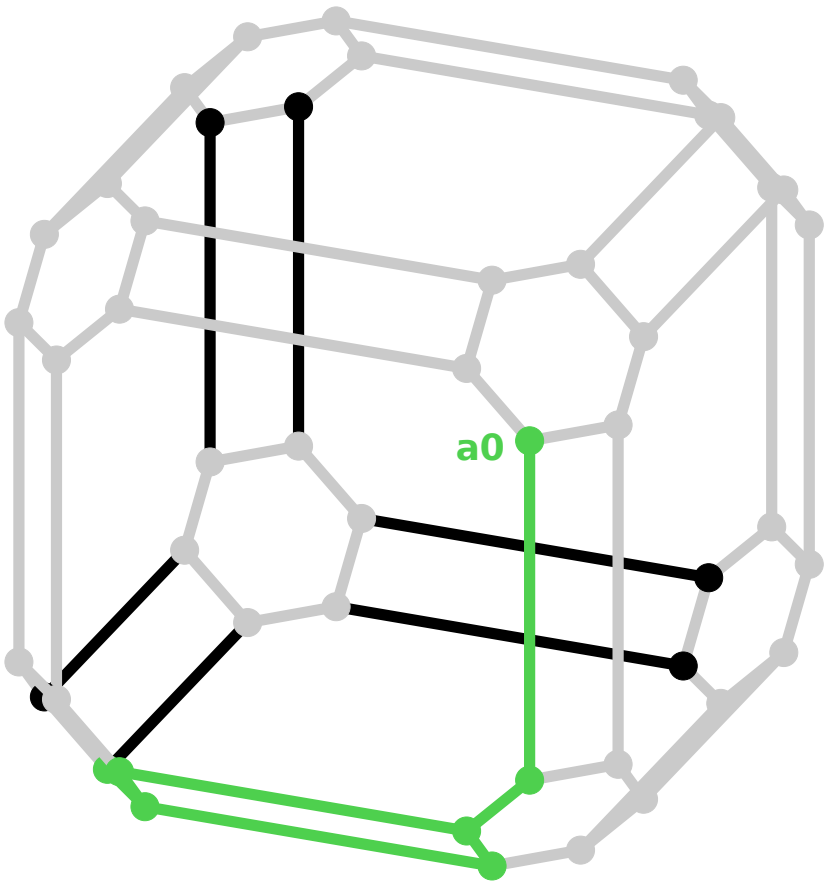
Constuction d'un nœud.

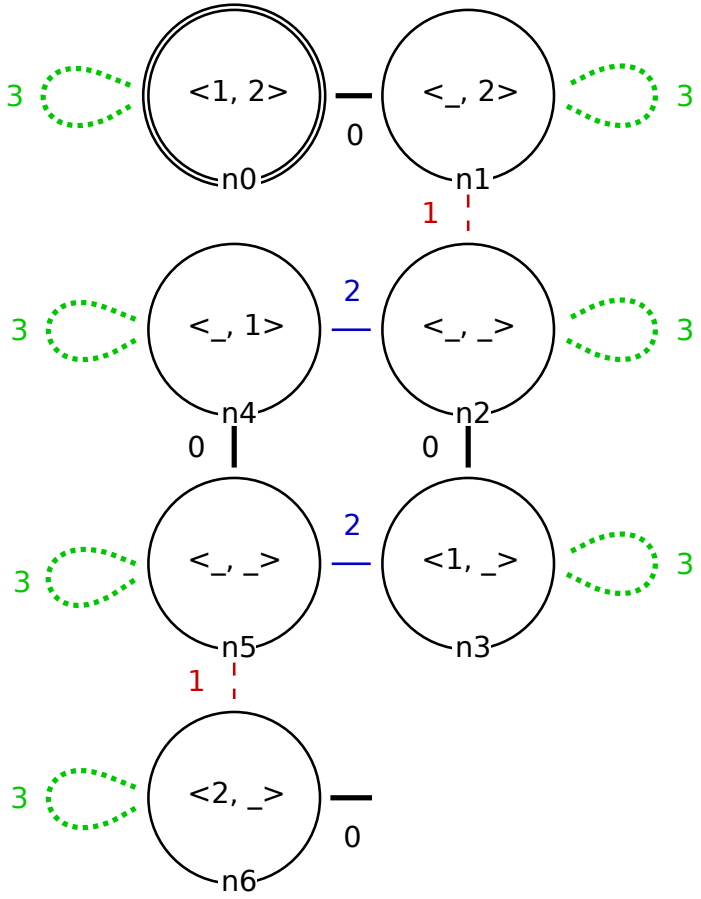




Détails de l'algorithme

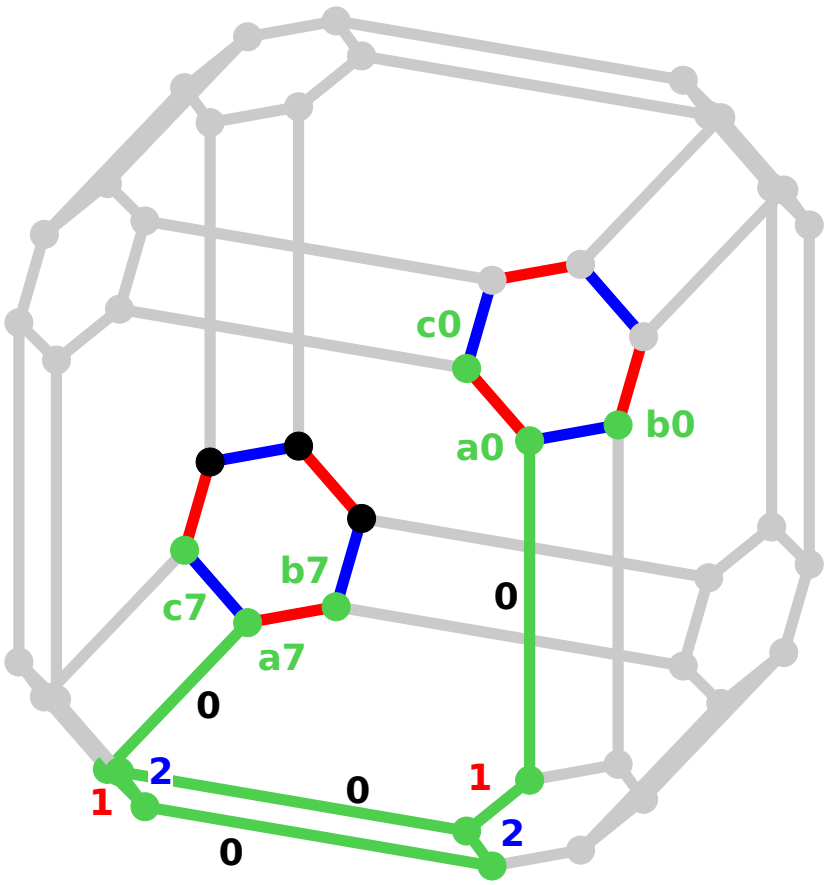
Extension des arcs.

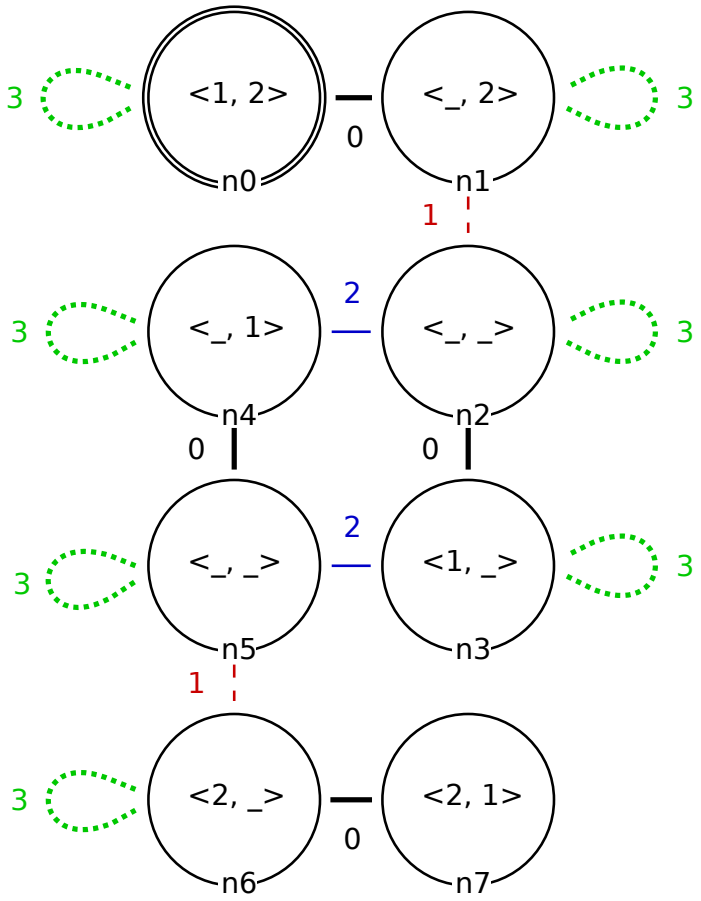




Détails de l'algorithme

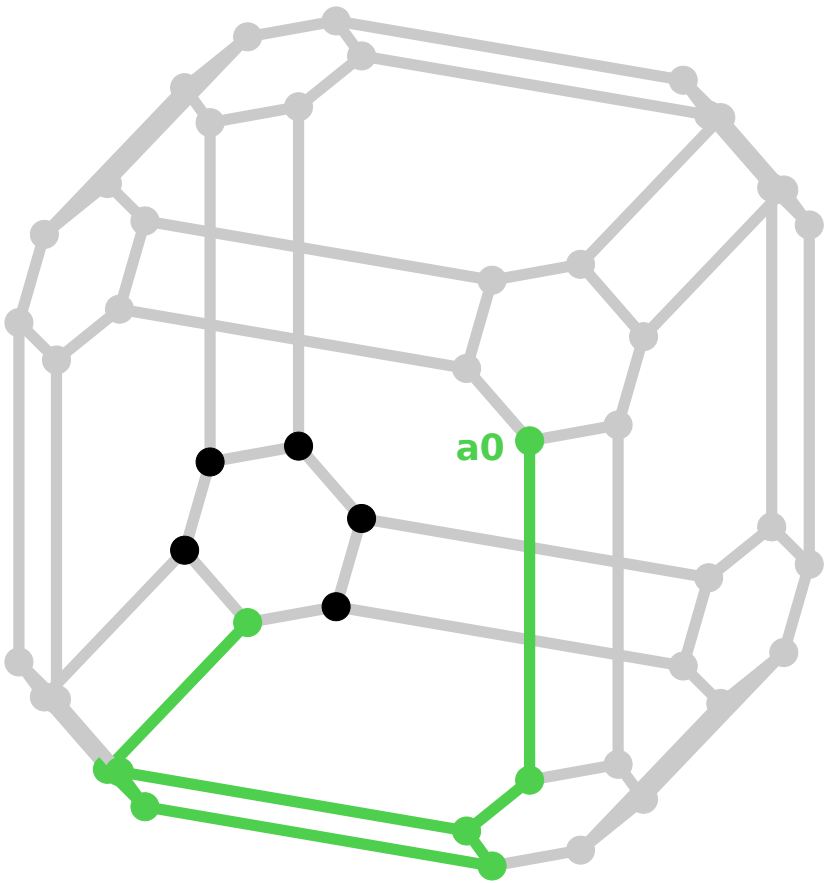
Constuction d'un nœud.

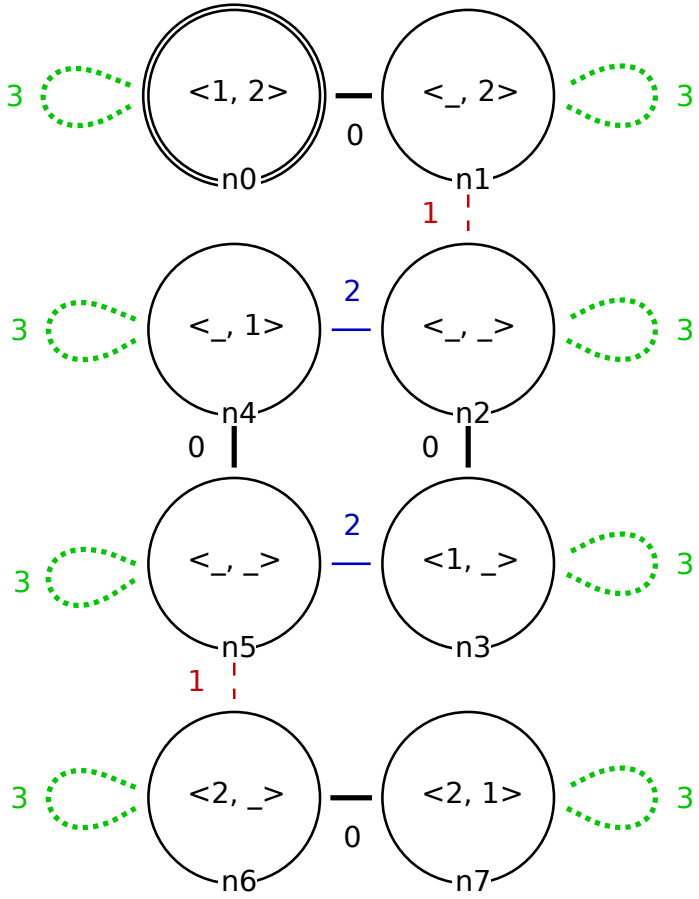




Détails de l'algorithme

Extension des arcs.

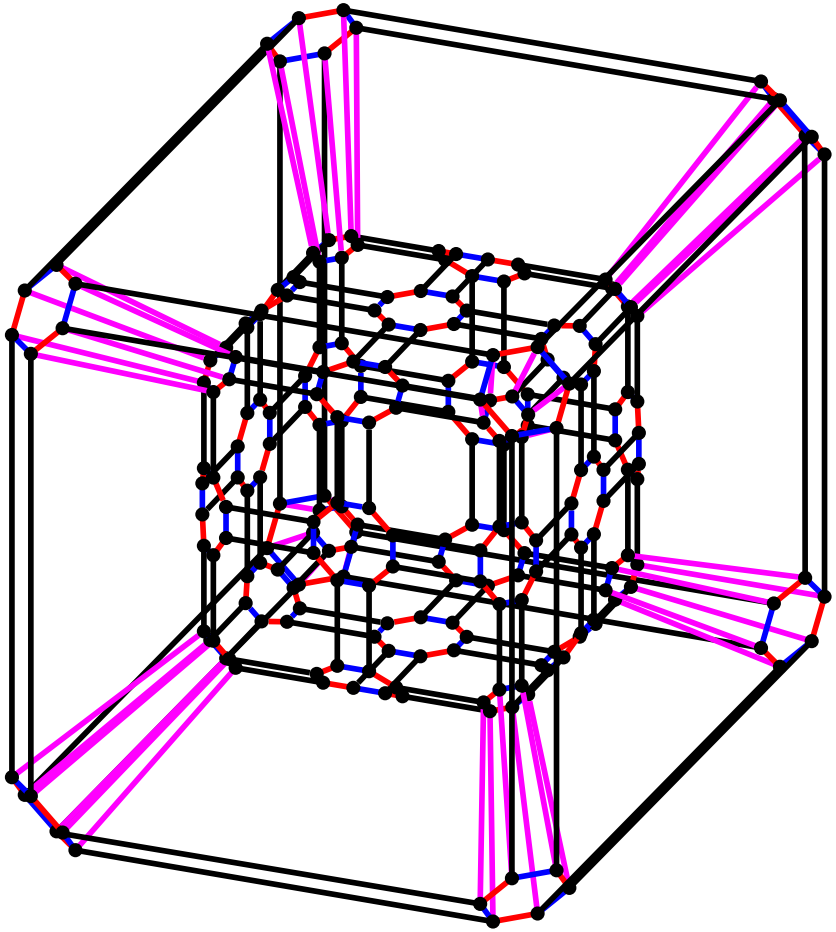




Généralisation aux deux instances

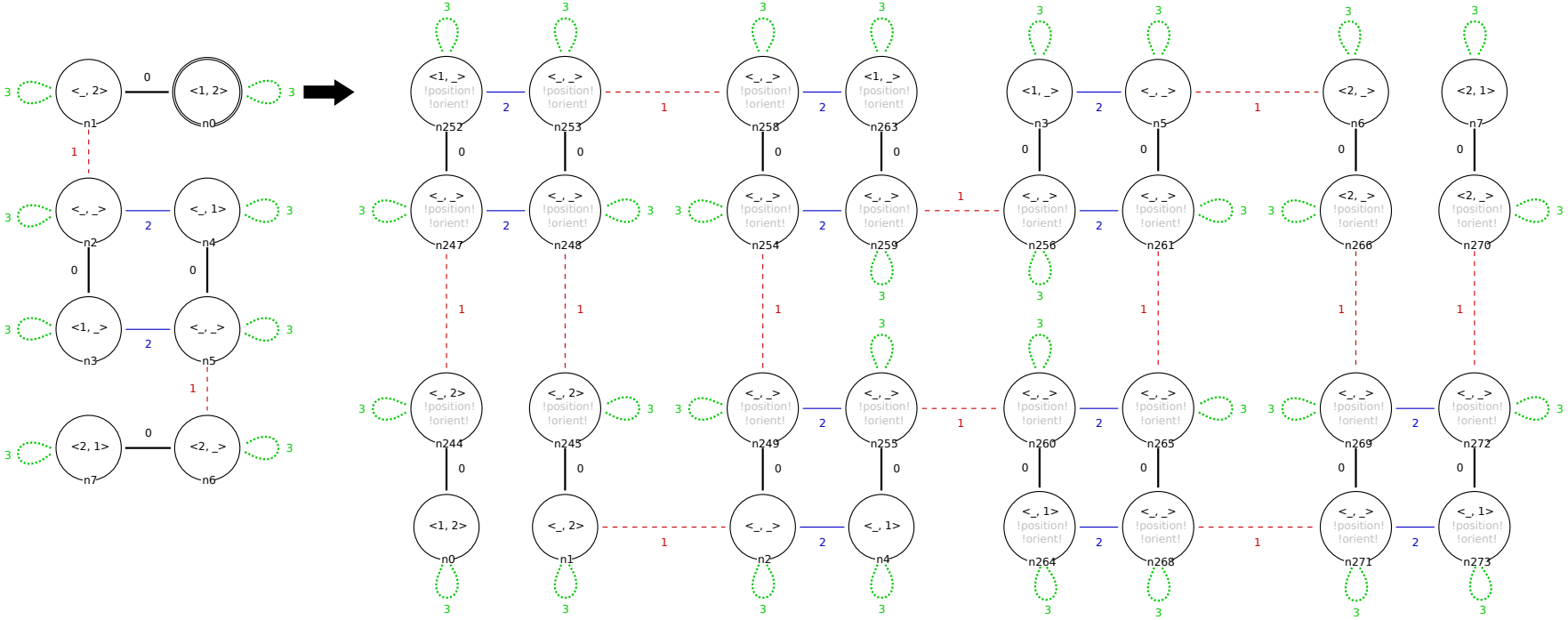
On a construit le schéma correspondant au membre gauche (l'instance "avant").

La construction se transpose à l'union de l'instance "avant" et de l'instance "après" à l'aide d'arcs reliant les brins préservés.



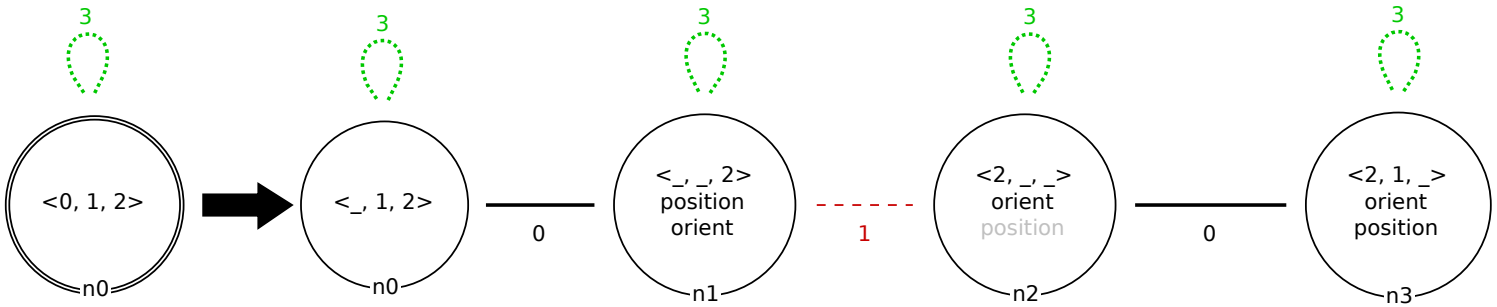
Résultat de l'algorithme

- Schéma de règle à partir d'un sommet du cube :

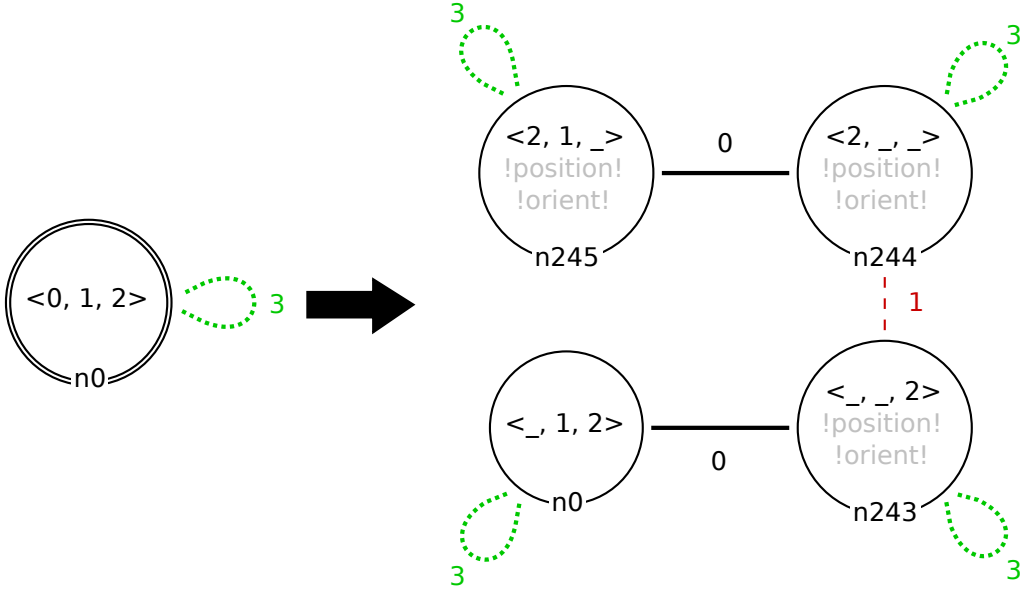


Subdivision de quad

- Schéma de règles utilisé :



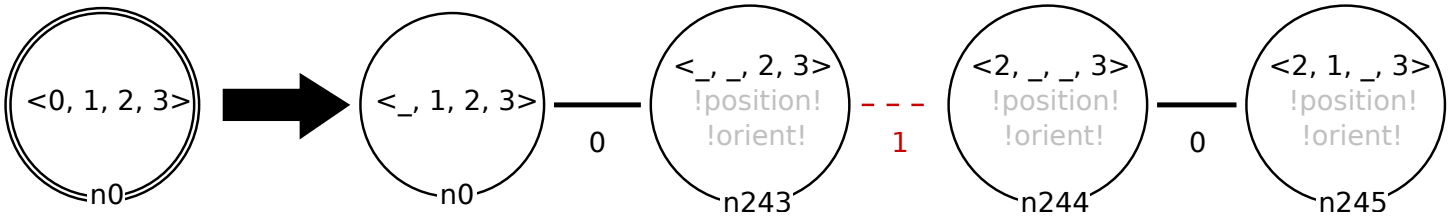
- Parmi les schémas inférés, on retrouve le schéma utilisé :



Autres schémas inférés pour la subdivision de quad

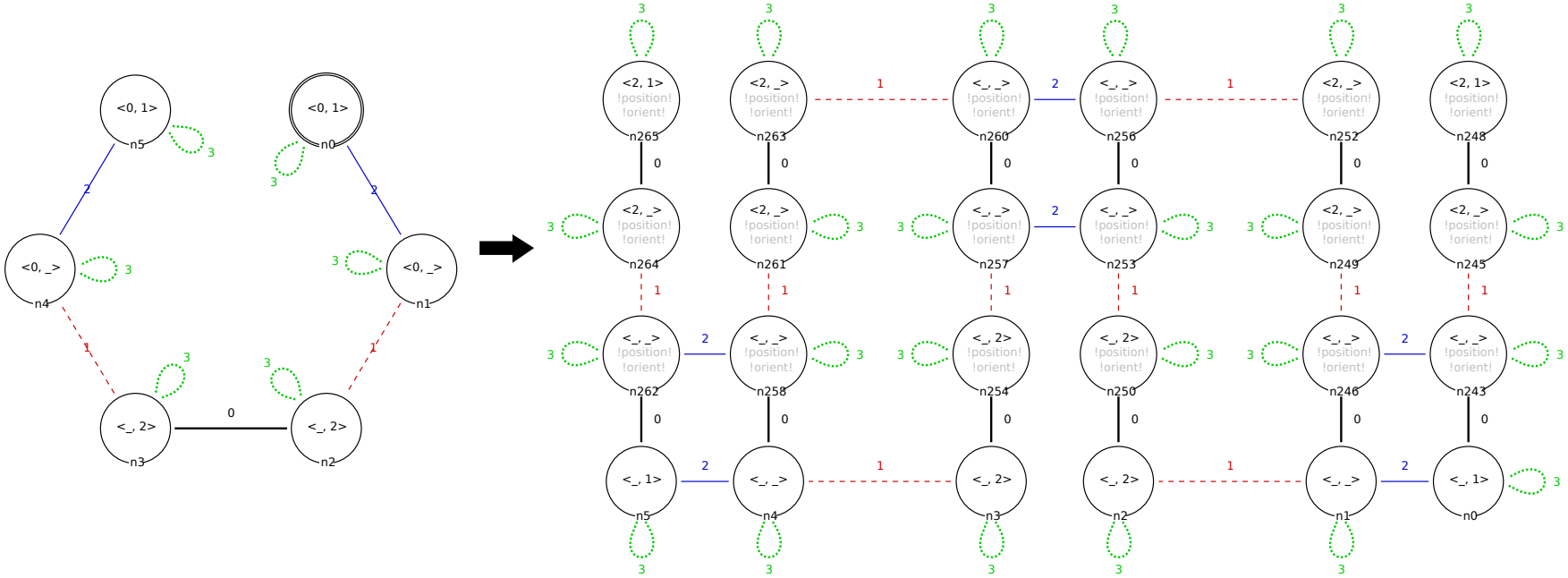
Il y a en tout 768 schémas possibles. La symétrie du cube assure qu'il n'y a que 16 schémas distincts. On a construit 48 schémas.

- Schéma pour une composante connexe.

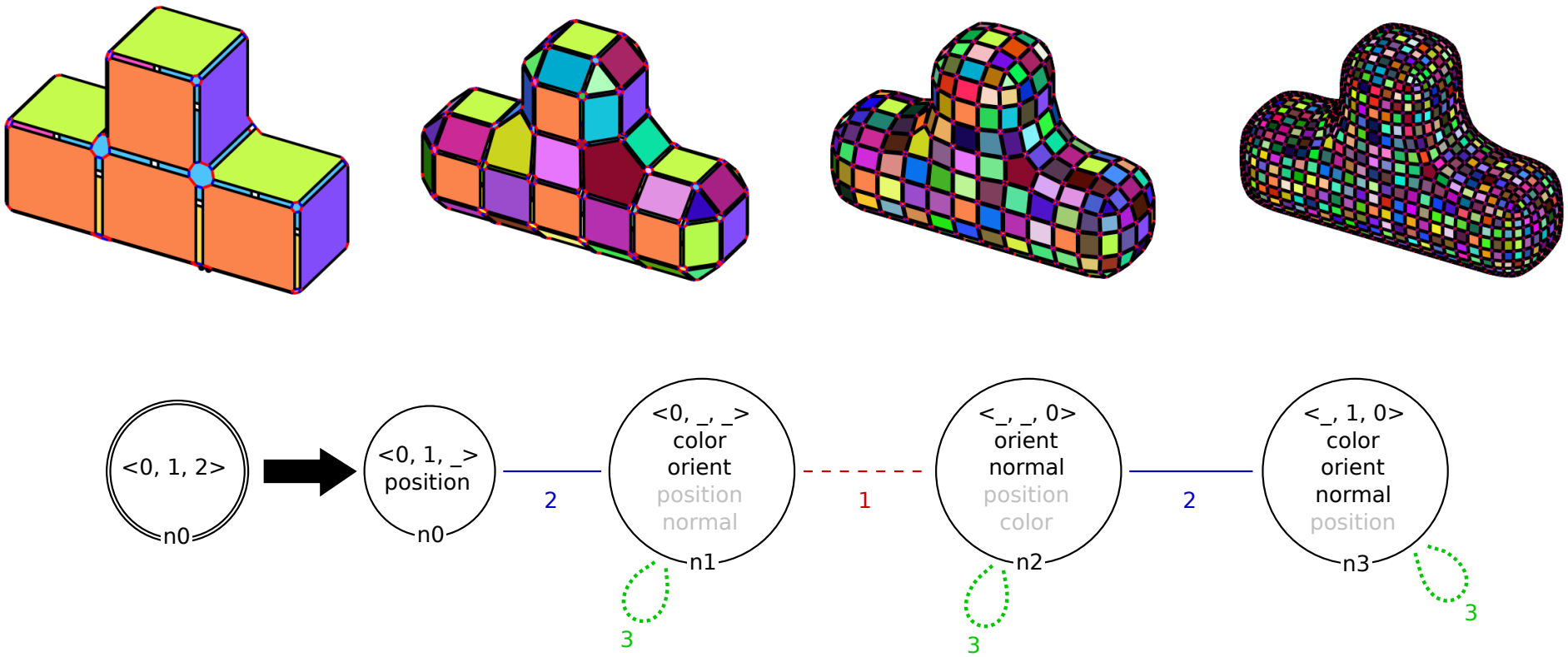


Autres schémas inférés pour la subdivision de quad

- Schéma pour une face.

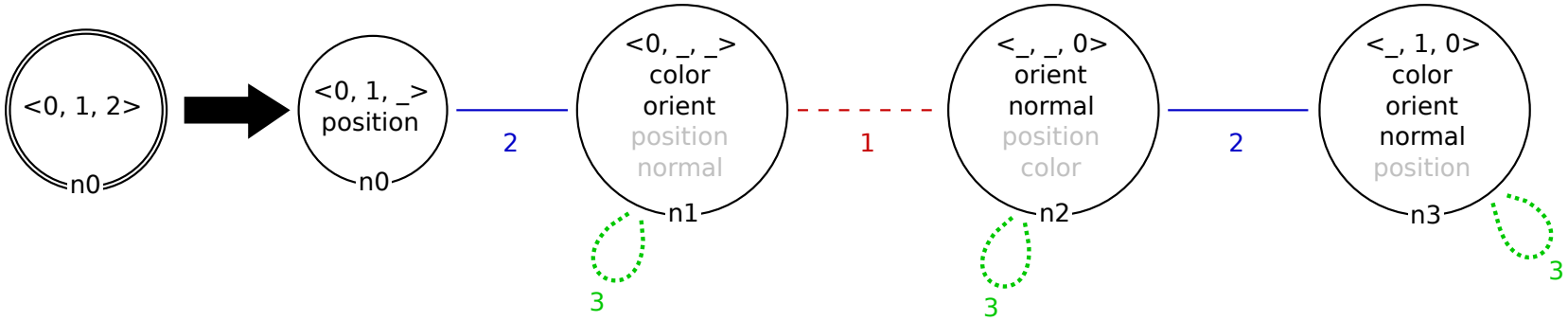


Subdivision de Doo-Sabin [DS78]

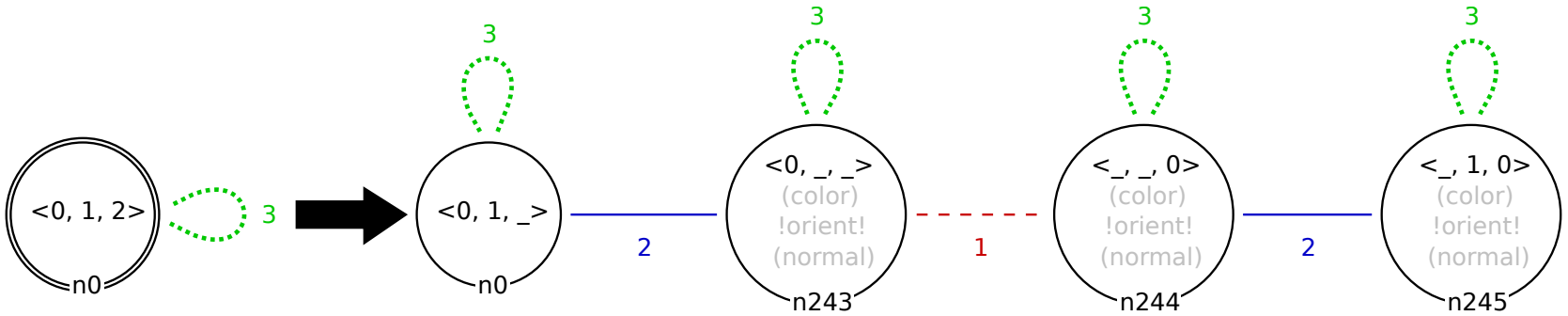


Opération correspondante

- Schéma de règles utilisé :

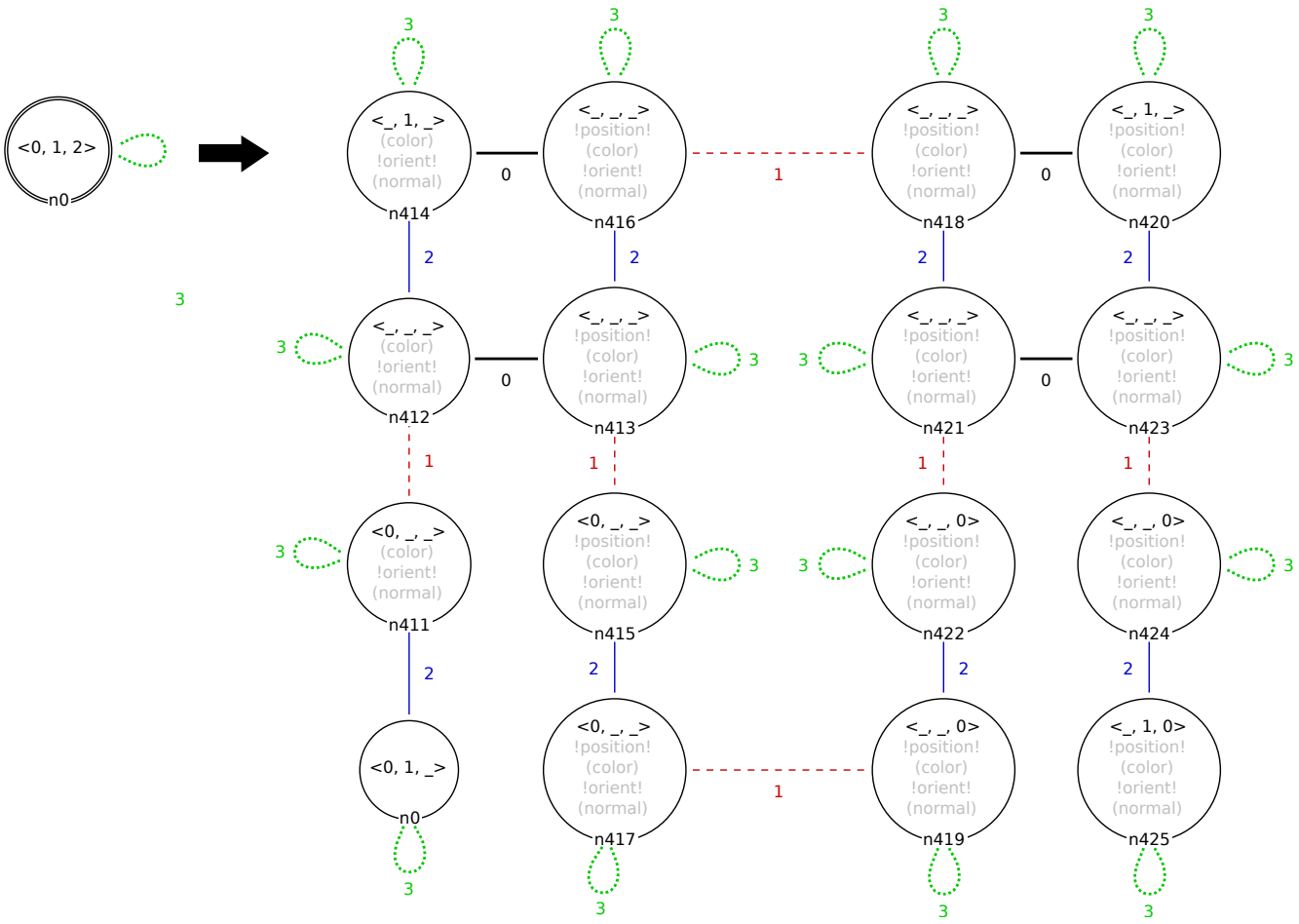


- Schéma de règles inféré :



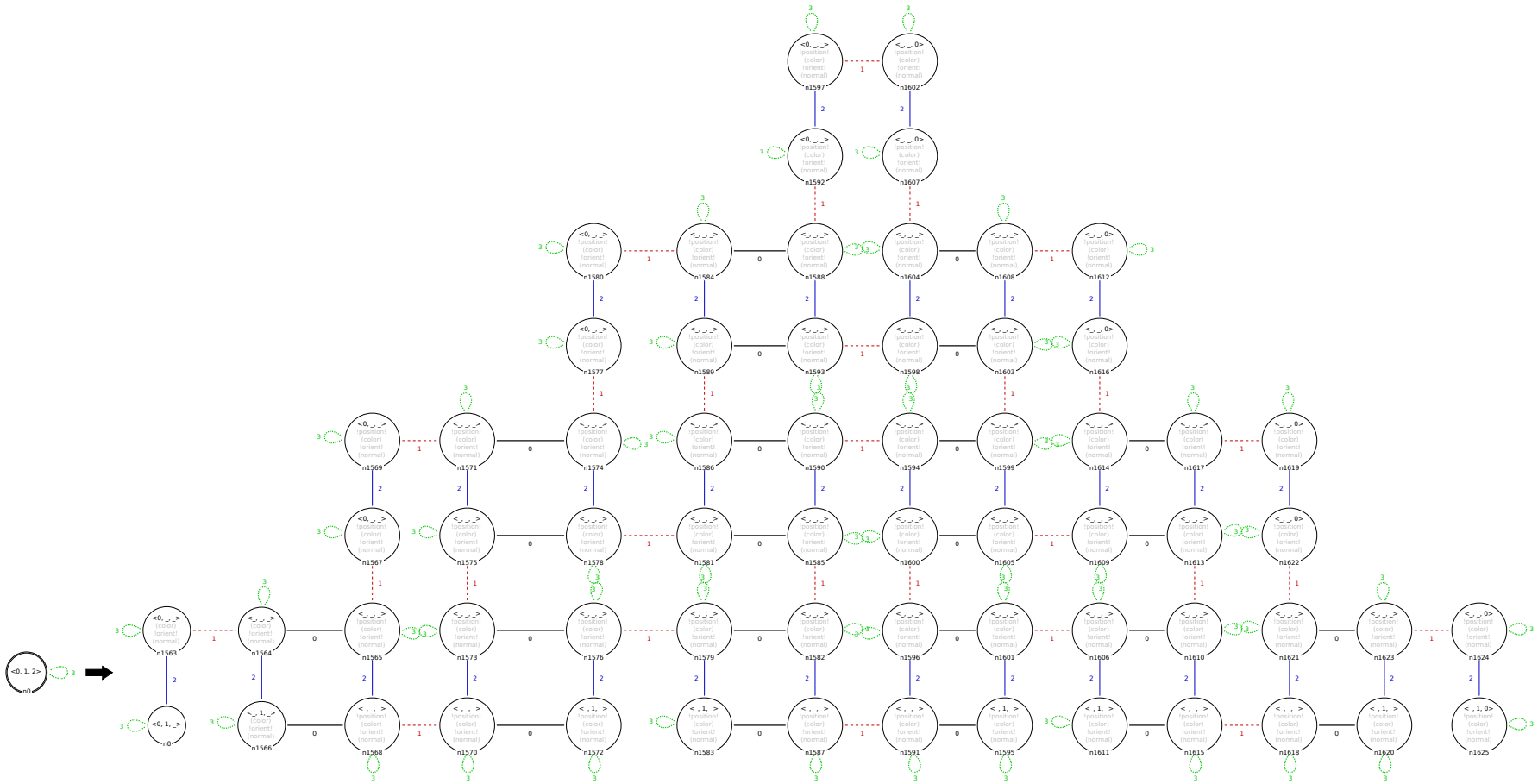
Subdivision de Doo-Sabin itérée

- Schéma de règles inféré (deux itérations) :



Subdivision de Doo-Sabin itérée

- Schéma de règles inféré (trois itérations) :



Conclusion et perspectives

- L'algorithme permet donc de rétro-ingéniérer des opérations topologiques valides pour une opération donnée, à partir de deux instances d'un objet avant et après modification.

- Nous voulons mettre au point un processus analogue pour le calcul de la géométrie.

- Plus généralement, l'idée serait de cacher complètement la syntaxe des règles de Jerboa pour ne manipuler que des objets.

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