Appendix A. Convex gauge function of a *Corner* exclusion zone

For a non-empty convex body $C \subset \mathbb{R}^n$ centered on the origin O, the gauge function of C is defined as:

$$g_C(x) = \inf\{\lambda \geqslant 0 \mid x \in \lambda C\} \qquad (A.1)$$

The gauge function is a Minkowski functional taking positive values less than 1 when $x \in C$, being equal to 1 when $x \in \partial C$ the boundary of C, and greater than 1 when $x \notin C$. Intuitively, the gauge function $g_C(x)$ corresponds to the factor (λ) by which the convex body C must be dilated or contracted to contain x. In particular, the gauge function of the unit ball is the Euclidean norm.

In our method, the exclusion zone associated to a *Corner* is a convex shape. The corresponding gauge function is used to determine the point in another model entity (e.g. a *Line*) that is the nearest to a free *Corner* (Fig. A.14). Using the convex gauge function instead of Euclidean distance allows to use anisotropic direction in the nearest point requests.
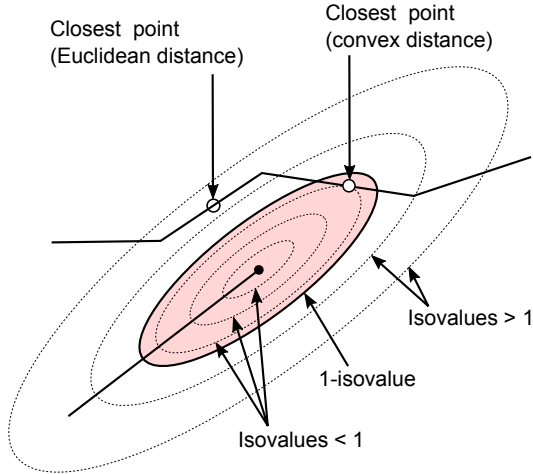

Figure A.14: The gauge function of the free *Corner* exclusion zone (red) is used to determine the nearest point to the free *Corner*. Note that if the exclusion zone is anisotropic the nearest point using the convex gauge function is generally different from the nearest point using the Euclidean distance.

Appendix B. Graph edit operations for partial *Line* editing

When the collision between two *Line* exclusion zones do not concern the whole *Lines*, graph edit operations like edge contraction or node removal are performed in two steps (Fig. B.15):

1. The *Line* nodes are first split to strictly represent the individual entity parts involved in the invalid edge. This implies that new *Corners* are inserted between each new *Line* part node. Therefore, connectivity edges are added between the new *Corner* nodes and the split *Line* part nodes. Incident invalid edges are reallocated to the new nodes depending on the *Line* portions stored in their property. Invalid edges are added between the pairs of additional *Corner* nodes bounding invalid *Line* parts (additional *Corners* C_1 and C_2 in Fig. B.15b).
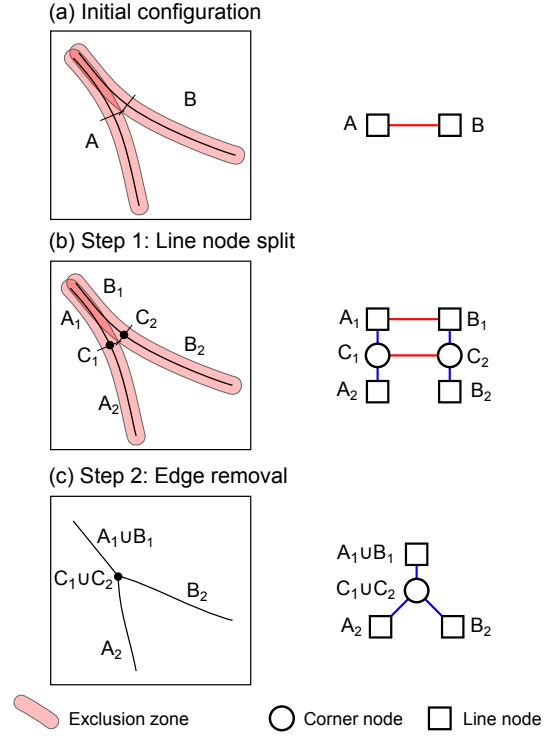

Figure B.15: *Line-Line* invalid edge removal using partial edge contraction is performed in two steps.

2. Then new and reallocated invalid edges are removed by either node deletion or edge contraction (Fig. B.15c).

Appendix C. Authorized graph operations

The allowed or not graph operations (Fig. 8) to remove invalid features depend on the entity types of nodes linked by the edge (Table C.1).

Table C.1: Allowed and not allowed graph elementary operations (Fig. 8) to remove invalid feature depending on the node entity types (*Corner* or *Line*). A plus (+) symbolizes an allowed operation and a minus (−) a forbidden operation. [1] : a *Corner* cannot be removed as it is related to the *Line* it bounds. [2] : the *Corner* cannot be removed ([1]) and we forbid whole *Line* removal in *Corner-Line* invalid configuration. [3] : only the *Line* node can be split.

| | Corner | | | |
	Edge deletion	Edge contraction	Node removal	Node split
Corner	+	+	−[1]	−
Line	+	−	−[2]	+[3]

| | Line | | | |
	Edge deletion	Edge contraction	Node removal	Node split
Line	+	+	+	+