

Efficient Methods for Order Reduction of Zonotopes

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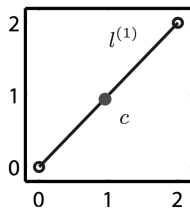
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Zonotopes

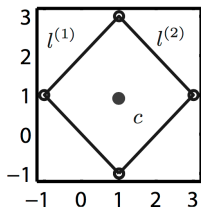
- Zonotopes are set representations defined by

$$\mathcal{Z} = \left\{ c + \sum_{i=1}^p \alpha_i g^{(i)} \mid \alpha_i \in [-1, 1] \right\}, c \in \mathbb{R}^n, g^{(i)} \in \mathbb{R}^n$$

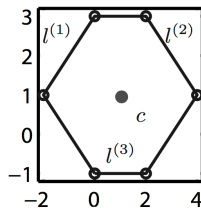
- \mathcal{Z} is the Minkowski sum of line segments $l^{(i)} = [-1, 1]g^{(i)}$



(a) $c \oplus l^{(1)}$



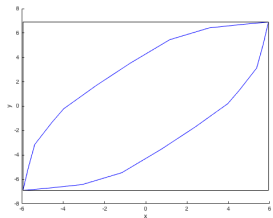
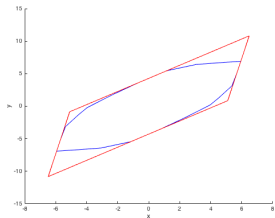
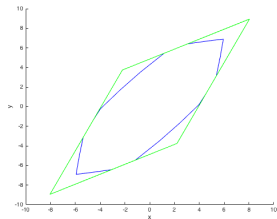
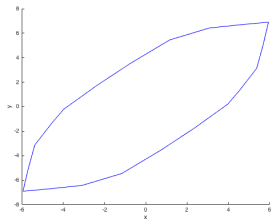
(b) $c \oplus l^{(1)} \oplus l^{(2)}$



(c) $c \oplus \dots \oplus l^{(3)}$

[M. Althoff: CORA 2015 Manual]

Order Reduction of Zonotopes: Different Ways



Topic: Efficient Methods for Order Reduction of Zonotopes

- Different ways possible to reduce zonotope order
- Resulting zonotopes and computation times differ significantly
- **Goal:** Find a fast and numerical stable approach for order reduction of high-dimensional zonotopes
- **Tasks:**
 - Develop new approach for order reduction of zonotopes
 - Implement new approach and/or existing approaches in Matlab
 - Compare the approaches

Questions?

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