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The Norming Set of a Bilinear Form on R² with the Octagonal Norm

An element $(x_1, \dots, x_n) \in E^n$ is called *norming point* of $T \in \mathcal{L}(^nE)$ if

$$\|x_1\| = \cdots = \|x_n\| = 1 \ \text{ and } \ |T(x_1, \dots, x_n)| = \|T\|,$$

where $\mathcal{L}(^nE)$ denotes the space of all continuous n-linear forms on E. For $T \in \mathcal{L}(^nE)$, we define

$$\operatorname{Norm}(T) = \{(x_1, \dots, x_n) \in E^n : (x_1, \dots, x_n) \text{ is a norming point of } T\}.$$

Let $\mathbb{R}^2_{o(w)}$ denote $\mathbb{R}^2$ with the octagonal norm with weight $0 < w \neq 1$

$$\|(x, y)\|_{o(w)} = \max\left\{|x| + w|y|, |y| + w|x|\right\}.$$

We classify $\operatorname{Norm}(T)$ for every $T \in \mathcal{L}(^2\mathbb{R}^2_{o(w)})$ with weight $0 < w \neq 1$ in this paper.

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