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Level sets of condition spectrum

Abstract

For $0 < \epsilon \leq 1$ and an element $a$ of a complex Banach algebra $\mathcal{A}$ with unit $e$, the level set of $\epsilon$-condition spectrum is defined as

$$L_\epsilon(a) ::= \left\{ \lambda \in \mathbb{C} : \|(a - \lambda e)e\| \|(a - \lambda e)^{-1}\| = \frac{1}{\epsilon} \right\}.$$

We prove the following topological properties about $L_\epsilon(a)$

1. If $\epsilon = 1$ then $L_1(a)$ has an empty interior unless $a$ is a scalar multiple of the unit.

2. If $0 < \epsilon < 1$ then $L_\epsilon(a)$ has an empty interior in the unbounded component of the resolvent set of $a$. Further, we show that, if the Banach space $X$ is complex uniformly convex or $X^*$ is complex uniformly convex, then for any operator $T \in B(X)$, $L_\epsilon(T)$ has an empty interior.

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