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ORIGINAL RESEARCH PAPER

Mappings contracting axes of ellipse

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Abstract

This paper deals with a new contractive type mapping known as mapping contracting axes of ellipse. We introduce a mapping that shrinks both the major and minor axes and increases the ecentricity of an ellipse. This is a geometric technique that is connected to the study of geometric characteristics of certain points and curves, and that are fixed by the considered self-mapping over a metric space. The paper is furnished by some suitable examples that support our results and showing that our mapping is distinct from the usual contractive type mappings. Finally a geometric figure is illustrated to describe the true nature of our mapping.

Keywords Fixed point · Ellipse · Mappings contracting axes of ellipse · Complete metric space

Mathematics Subject Classification 47H10 · 54H25

1 Introduction and preliminaries

Let us consider a complete metric space $(\mathcal{M}, D)$ and Banach contraction mapping [1] $\mathcal{T} : \mathcal{M} \to \mathcal{M}$ satisfying

$$D(\mathcal{T}\xi, \mathcal{T}\eta) \leq hD(\xi, \eta) \text{ for all } \xi, \eta \in \mathcal{M}, \text{ where } 0 \leq h < 1.$$

Then $\mathcal{T}$ has a unique fixed point in $\mathcal{M}$. If θ is the unique fixed point of $\mathcal{T}$, then

$$D(\mathcal{T}\xi, \theta) \leq hD(\xi, \theta) \text{ for all } \xi \in \mathcal{M}. \tag{1.1}$$

Therefore if we consider a circle $\mathbf{C} = \{\xi \in \mathcal{M} : D(\xi, \theta) = r\}$, then the image of this circle will be contained in the closed disc

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