# Fractals as Julia and Mandelbrot Sets of Complex Cosine Function via Fixed Points Iterations

Vipul Kumar[1*], Anita Tomar[2], and U. S. Rana[1]

[1]D.A.V. College Dehradun, (Uttarakhand) India
[2]Sri Dev Suman Uttarakhand University, Pt. L.M.S. Campus Rishikesh, (Uttarakhand) India

[*]Corresponding Author

## ABSTRACT

In this manuscript, we explore stunning Julia and Mandelbrot fractals of complex-valued cosine functions by establishing the escape criteria via a four-step fixed point iteration scheme extended with s-convexity. We furnish some graphical illustrations to demonstrate the variation in images and study the impact of involved parameters on the deviation of color, dynamics, and appearance of generated complex fractals. The black points in the obtained fractals are the "non-chaotic" points, and the dynamical behaviour in the black area is easily predictable. The colored points are the points that "escape," that is, they tend to infinity under the four-step fixed point iteration scheme extended with s-convexity. The different colors tell us how quickly a point escapes. Red points escape fastest, followed in order by orange, yellow, green, blue, and violet points. The boundary between these two types of behavior points is the Julia set, where we encounter all of the chaotic behavior for the dynamical system. The collection of all possible Julia sets is the Mandelbrot sets, which was first viewed in 1980 by Benoit Mandelbrot, is very significant in dynamics. It completely characterizes the Julia sets.

**Keywords**: Escape parameter; s-convexity; fixed point.



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