

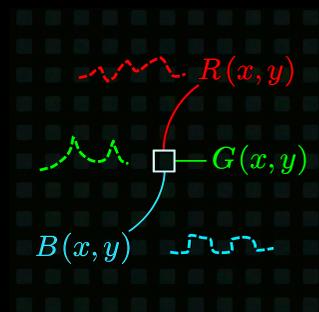
# From Equations to Illumination

My journey to creating this book is as much mathematical as it is aesthetic—a journey deeply rooted in my academic pursuit of signal processing. As an explorer immersed in the world of mathematical modeling, algorithms, and the analysis of real-world signals, my everyday language revolves around equations, functions, and algorithms. Yet, beyond the analytical rigor and mathematical abstractions, lies a profound fascination with the vibrant elegance of colors, patterns, and visual harmony.

This fascination has accompanied me throughout the years, nurtured by the timeless beauty found in architectural masterpieces—from the intricate mosaics of Persian mosques, like the spellbinding geometry of Isfahan’s Sheikh Lotfollah Mosque, to the mesmerizing rose windows of Gothic cathedrals, such as Chartres Cathedral in France or Notre Dame de Paris. These historical wonders share something deeply profound: they translate complex mathematics into astonishingly beautiful visual experiences. It’s hardly surprising that someone like myself, enamored by the mathematics underlying the colors and shapes of our visual perception, would find himself captivated by these masterpieces.

Indeed, the bridge between signal processing and the artistic designs presented in this book is intuitive yet profound. At its heart, image processing—the cornerstone of signal processing applied to visual signals—involves the mathematical manipulation of pixels, the basic building blocks of digital imagery. Each pixel is composed of three fundamental color channels: Red (R), Green (G), and Blue (B). Mathematically, every pixel can be represented as a vector in a three-dimensional RGB space:

$$\text{Pixel}(x, y) = \begin{pmatrix} R(x, y) \\ G(x, y) \\ B(x, y) \end{pmatrix},$$



where each channel's intensity at position  $(x, y)$  can be determined by a carefully selected mathematical function. The creativity and artistry in the designs you see within these pages emerge from the precision and careful tuning of these mathematical functions. Every design here has been created pixel by pixel, guided by intricate equations and meticulously refined algorithms.

Rose windows themselves carry centuries of cultural, spiritual, and historical significance. Originating in the medieval period, these magnificent windows became symbols of divine light, architectural elegance, and spiritual introspection. They were beacons of hope during humanity's most challenging eras, radiating ethereal light and geometric harmony into sacred spaces, offering comfort and contemplation. The rose window is a historical reminder of the enduring power of beauty, mathematics, and light as guiding forces amidst human uncertainty and darkness.

In our contemporary age, overwhelmed by rapid technology and digital saturation, perhaps it is time for the resurgence of rose windows. Who wouldn't be drawn toward their intricate patterns, their balanced symmetry, and their extraordinary interplay of colored light? Rose windows embody the exquisite balance between complexity and simplicity, structure and elegance—a visual representation of harmony that speaks deeply to the modern soul, searching for moments of stillness and wonder.

This book presents forty original rose window designs crafted meticulously over several years, each emerging from a harmonious dialogue between mathematics and aesthetics. They are my humble tribute to the traditions of geometric art, visual storytelling, and the timeless human fascination with patterns and colors.

I hope these windows bring you wonder, calm, and contemplation.

Mojtaba Soltanalian