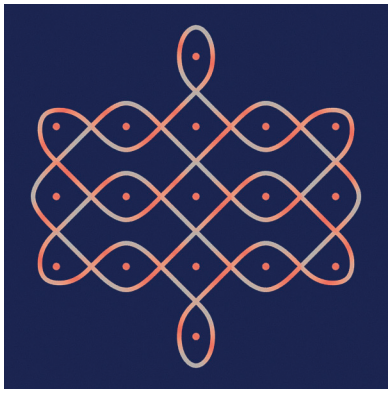
Tile-based kolam patterns

Saty Raghavachary
DreamWorks Feature Animation
saty@dreamworks.com

1 Introduction

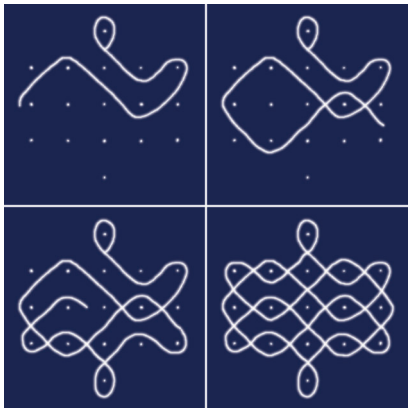
Kolams are centuries-old line patterns drawn at the thresholds of homes in Southern India. The figure below shows an example. The drawings are constructed from white flour or powdered limestone and have ornamental as well as religious significance in the Hindu tradition [Kalyanasundaram 1999]. The dot grid is laid down first, then the pattern is drawn in continuous loops which wind around the dots.



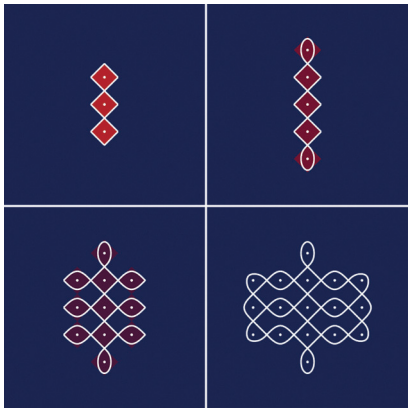
This sketch presents a set of 16 decorated tiles which serve as an alternate way to construct kolams. To the best of the author's knowledge, this is a novel approach. Existing characterizations of kolams have been in terms of two-dimensional picture grammars [Siromoney 1974] or L-systems [Inasu 1988]. Also, children are taught kolams using the dot-grid, curve-based continuous drawing technique used by adults, which makes it difficult to memorize them or create variations. Tile-based construction instead offers an inviting approach more suitable for experimentation.

2 Tile-based construction

Pictured below is a typical progression in the construction of the kolam shown above. The curve (just a single closed loop in our case) carefully meanders through the spaces in between the dots, creating a pleasing arrangement of overlapping segments.

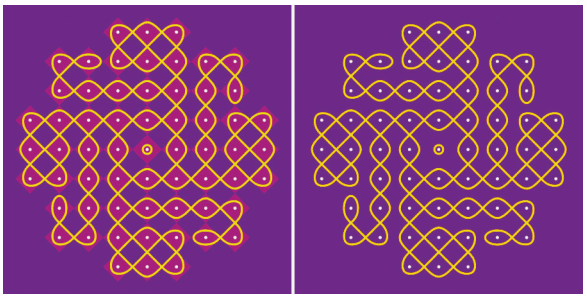


Instead of being drawn in a continuous manner, the same kolam can be generated in a completely different way, using diamond-shaped tiles placed corner to corner (not close-packed). The following image shows how. Each tile has markings on it (including a dot at the center), and an assembly of tiles with appropriate decorations creates the kolam when their piecewise markings link up to reproduce the overall curves.



It turns out that exactly 16 tiles are all that are necessary to capture the endless variety of kolams. The complete tile catalog is shown below. The topmost row contains an 'empty' tile with all four corners free. The other rows show tiles with one, two, three and four corners 'occupied' by decorations. Combinatorially, this is yields the set of C(4,0)+C(4,1)+C(4,2)+C(4,3)+C(4,4)=16 tiles. Creating valid kolams now becomes a matter of choosing adjacent tiles so that mating corners have curve segments crossing over (no dangling curves). This makes it amenable to algorithmic exploration using techniques borrowed from tessellation research.

Shown below is a more complex kolam that employs 15 out of the 16 pieces from the set (all except the last piece).



3 References

KALYANASUNDARAM 1999. Kolam - artwork of South India. *http://www.geocities.com/Athens/5180/kolam.html*

SIROMONEY, G. 1974. Array Grammars and Kolam. *Computer Graphics and Image Processing*, iii, 63-88.

INASU, V.P. 1988. Application of L-systems to the Algorithmic Generation of Kolam Patterns. *M.Tech Thesis*, *IIT Madras*.