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African *Sona*, Mirror Curves and Lunda-Designs

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1. African *Sona* and Mirror Curves

The *sona* tradition was developed in eastern Angola and neighbouring areas of today's Zambia and Congo/Zaire (GERDES, 1995). Illustrations in the sand accompanied story telling among the male Cokwe population. *Sona* are composed of lines embracing the dots of a reference frame of certain dimensions. Most *sona* are monolinear (composed of one line) and symmetric (GERDES, 1999, 2006a) (Fig. 1).

A particular class of traditional *sona* may be described as mirror-curves (GERDES, 2006b). The chased chicken's path constitutes an example of a mirror-curve (Fig. 2). It may be considered as the smooth version of a polygonal line that is reflected in small double-sided mirrors that are placed—some horizontally, some vertically—in the middle between either two vertical, or two horizontal neighbouring dots of the reference frame. During the presentation an introduction to *sona* geometry will be given, as well as an explanation of the generation and principal properties of mirror-curves.

2. From Mirror Curves to Lunda-Designs and Cycle Matrices

The concept of mirror-curves was discovered by me when I was analysing a particular

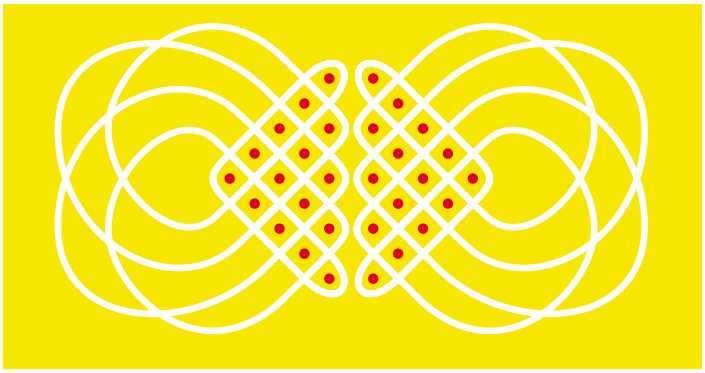

Fig. 1. Cover design of the book *Sona Geometry from Angola*.

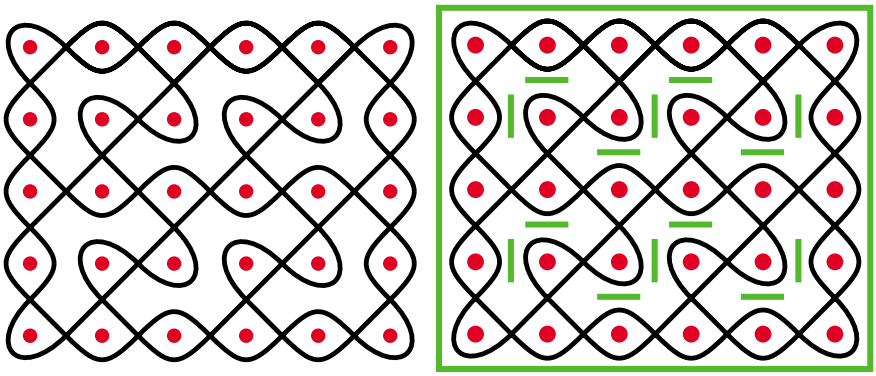

Fig. 2. The traditional *lusona* representing the chased chicken's path (left) and the chased chicken's path as a mirror-curve (right).

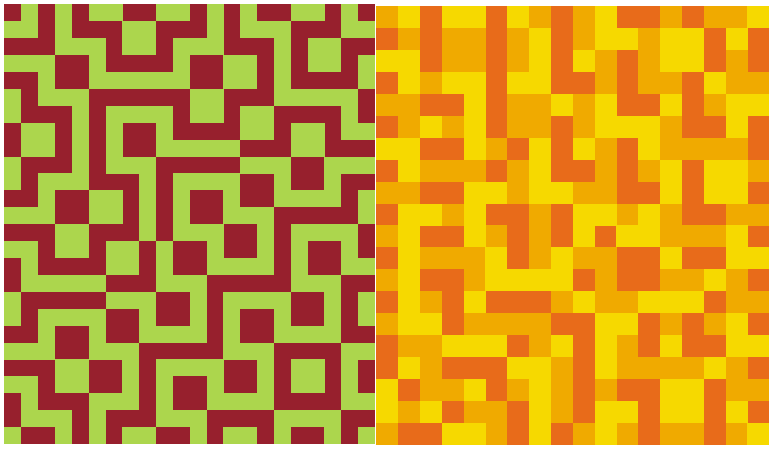

Fig. 3. Examples of a 2-colour Lunda-design and of a 3-colour design.

class of traditional *sona* drawings from Angola. Later I saw that several Tamil *kolam* drawings from India and Celtic knots may also be described as mirror-curves.

The mathematical study of mirror-curves led me to discover several new types of designs and matrices (GERDES, 2007): First of all, various types of *Lunda-designs* and Lunda-matrices (Fig. 3); Later on, I found a particular class of Lunda-designs, that I called *Liki-designs*, that led me to discover a type of interesting matrices, called cycle matrices. By changing some characteristics of cycle matrices, I was led to several types of *helix matrices* and *cylinder matrices*. During the presentation I will present examples of *sona* and kolam that may be considered mirror-curves, and I will explain the relationships between mirror-curves, Lunda-designs and the various new types of matrices.

REFERENCES

GERDES, P. (1995) *Une tradition géométrique en Afrique.—Les dessins sur le sable*, L'Harmattan, Paris.

GERDES, P. (1999) *Geometry from Africa: Mathematical and Educational Explorations*, The Mathematical Association of America, Washington, D.C.

GERDES, P. (2006a) *Sona Geometry from Angola. Mathematics of an African Tradition*, Polimetrica, Monza.

GERDES, P. (2006b) *Adventures in the World of Matrices*, Nova Science Publishers, New York.

GERDES, P. (2007) *Lunda Geometry: Mirror Curves, Designs, Knots, Polyominoes, Patterns, Symmetries*, 196 pp. (internationally available in print and as download from lulu.com by going to "paulus gerdes", or at http://stores.lulu.com/pgerdes (preview available)).