Flowform Design for Biodynamic Preparations

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Introduction

Biodynamic preparations were invented by Rudolf Steiner (Ref. 3) and have been developed further since. They are intended to treat fields to improve yield and fertility in place of chemical treatments. The preparations are stirred ideally by hand for one hour. While this is satisfactory for use in gardens or perhaps smallholdings, for large farms some form of mechanical stirring has been found to be necessary to create the quantity required in a reasonable time. The rationale of the preparations is to harness cosmic forces which promote the health and growth of plants, an aspect reaching beyond the current materialistic scientific paradigm. Steiner stressed the importance of the human hand in mediating such cosmic forces, and so was concerned about purely mechanical methods.

The invention of the Flowform by A. John Wilkes (Ref 6) opens up the possibility of a rhythmic way of stirring the preparations (than mere mechanical stirring) that is more in accord with the cosmic and life processes involved. Flowforms have been used to good effect in this way (*ibid*). A question arises as to the design of the Flowform involved, and to date the Flowforms used were "off the shelf", not specifically designed for the purpose. This paper describes an approach to designing a Flowform specifically for stirring biodynamic preparations.

Mathematical Approach

A Flowform consists of two adjacent basins with a channel between them such that water flows into the channel and then diverts into the basins before flowing out, which yields a rhythmic vortex-like movement in each basin (Ref 6). The surfaces of the basins may be mathematically designed, which had been tried successfully by John Wilkes many years ago (*ibid*). Such surfaces may be vortical path curves (see Refs. 1 and 5 for an introduction to path curves) which have the advantage that they explicitly involve a polarity between point-like and plane-like processes. This is envisaged to capture an interaction between earthly and cosmic forces respectively.

The simplest surface based on path curves has a central axis of symmetry with vertical cross-sections that may be egg-shaped or vortex shaped, as illustrated in the following diagram:

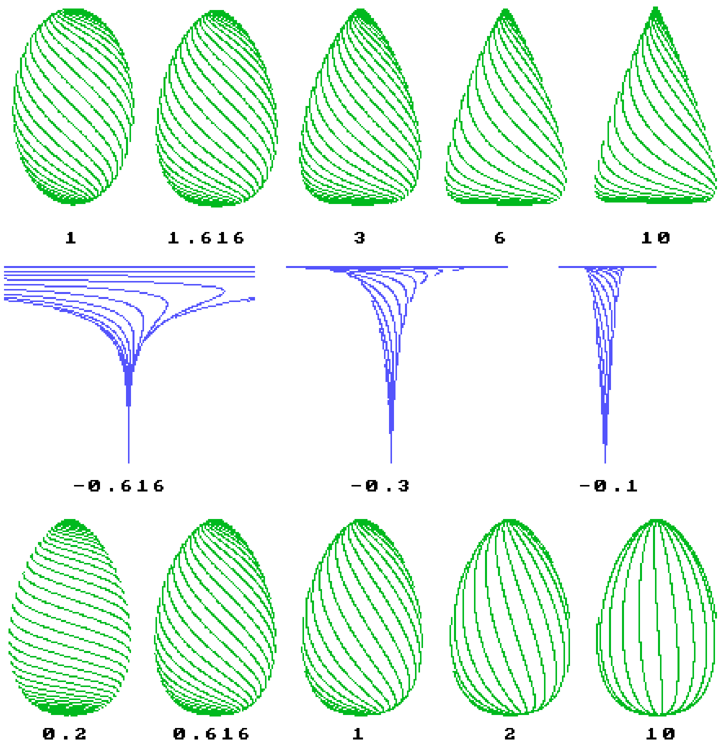

Figure 1

The top line shows a series of eggs of increasing "sharpness", measured by the parameter λ, so that an ellipsoid arises for $\lambda=1$, and already with $\lambda=10$ the form is nearly conical. The shape is actually formed by path curves which spiral upwards about the axis of symmetry and all pass through a horizontal circle centred on that axis. Then all horizontal cross-sections are circles. Now circles are special cases of path curves, so the shape is woven of two sets of intersecting path curves. There are many sets of intersecting path curves that produce the same shape, for example one path curve could be taken winding in the opposite sense about the axis, and then the set of curves shown would all intersect it. Similar considerations apply to the vortices in the second row. The bottom row shows eggs all with same λ but with path curves of distinct steepness, controlled by a parameter ϵ (Ref 5). If $\epsilon=0$ the path curves become horizontal circles.

More general surfaces woven of path curves may be obtained by taking the horizontal cross-sections as logarithmic spirals instead of circles.

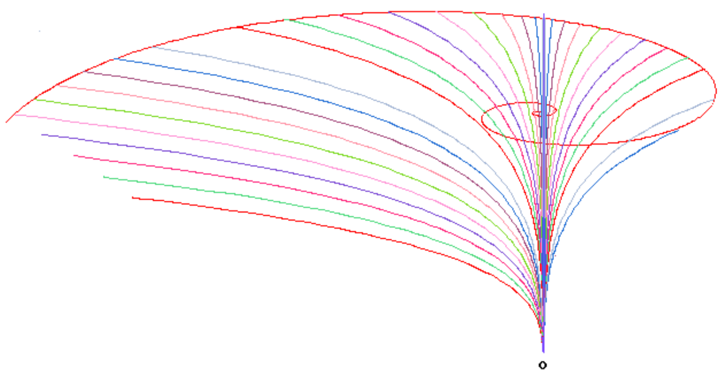

Figure 2

The figure shows part of such a surface where vertical vortex path curves all of the same λ intersect the spiral to make up the surface. Every horizontal plane intersects the surface in a logarithmic spiral.

The vertical cross-sections have a definite λ-value as we have seen. However a spiral path curve may exist in the surface, and it will have a different λ-value, as may be appreciated by rotating all the points of such a curve horizontally into a fixed vertical plane. Because we have horizontal spirals instead of circles those points will not lie on a vertical cross-section of the surface. For this reason we use λ to characterise the spiral path curves in the surface, and μ for the "λ-value" of the vertical cross-sections. The formula relating the parameters of the spiral path curves (Ref. 1 Appendix 2) is

$$\mu=\frac{\epsilon+\alpha+\beta}{\epsilon-\alpha-\beta}$$

where α is defined by

$$\lambda=\frac{\epsilon+\alpha}{\epsilon-\alpha}$$

so that the formula relating λ, μ and ϵ is

$$\mu=\frac{(\lambda+1)(\epsilon+\beta)+\epsilon(\lambda-1)}{(\lambda+1)(\epsilon-\beta)-\epsilon(\lambda-1)} \quad (1)$$

β is the parameter of the logarithmic spirals in the equation $r=r_0 e^{\beta\theta}$. If β=0 the spirals degenerate to circles as *r* is constant with varying θ, and then from (1) μ=λ and the distinction between μ and λ vanishes.

Since (1) is linear in all its variables, we may freely choose any three of the parameters to find the fourth. Setting the denominator to zero gives μ=∞ i.e. a conical spiral surface, for $\beta(\lambda+1)=2\epsilon$. The surface itself is uniquely defined by μ and β (c.f. Figure 2 where μ defines the vortex profiles and β the spiral), and clearly many combinations of λ and ϵ satisfy (1) for a given surface. For our present purposes we will be interested in two particular sets of path curves for a given surface, namely the *asymptotic curves* of the surface (see below). We will find that two sets of such curves uniquely define a surface of the above type, and this will be used to define a surface based upon the λ-values of a cow horn and a water vortex.

Asymptotic Curves

As already stated, a path curve involves a polarity between point-like and plane-like processes which is envisaged to capture an interaction between earthly and cosmic forces respectively. This is because such a curve may be generated point wise using a linear collineation of points, and also plane wise using a linear collineation of planes. In the latter case a *developable* is obtained from the sequence of planes which is polar to the points of the former method. A developable possesses a *cuspidal edge* which in the case of a dual linear transformation is the same curve as the path curve. Hence there is an intimate relation between the earthly point-based process and the cosmic plane-based one. The asymptotic curves of the surfaces considered in this article are also path curves with that property, and mediate between the inward-looking earthly aspect of positive curvature and the outward-looking cosmic aspect of negative curvature. Now we will briefly describe what asymptotic curves are.

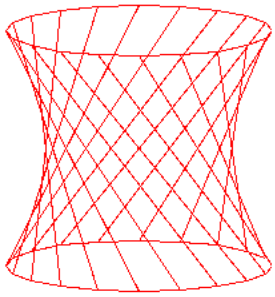

Figure 3

The regulus shown is a *ruled surface* i.e. it is completely covered by two sets of straight lines (truncated for convenience) called rulers. Horizontal planes cut the surface in circles in this case. The curvature of a circle is said to be positive because the principal normal to the curve at a point is directed inwards. Vertical cross sections such as that of the diagram cut the surface in hyperbolas, which have negative curvature since the principle normal at a point is directed outwards. Now imagine a plane rotating about a diameter of one of the circular cross-sections. If it starts out horizontal then it cuts the plane in a curve with positive curvature, but when it becomes vertical the curvature has become negative. One position of the plane will contain a ruler, where the curvature changes from positive to negative. Clearly the rulers are not curved, or may be said to have zero curvature, and are thus the curves of transition from positive to negative curvature. Although they are not curves in this case, being straight lines, they are however examples of asymptotic curves. Any curve in the surface which is tangential to a ruler at a point P has zero curvature at P, whereas a curve through P not tangential to a ruler has non-zero curvature at P. The ruler marks the direction at which a transition from curves with positive to those with negative curvature occurs. The ruler thus defines an *asymptotic direction* at which this change of sign occurs.

However, the surface depicted in Figure 2 also has asymptotic curves (not shown) which are not straight lines as the surface is not ruled. At a point P of the surface there are two *asymptotic directions* which have the same relation to the surface as the rulers in Figure 3 for the regulus, these directions being tangents to the surface at P. Starting from such a direction at P we can move P in the surface to describe a curve such that every one of its tangents is an asymptotic direction. The resulting curve is an asymptotic curve of the surface, and there are two such curves passing through every point of the surface. Clearly the tangent to an asymptotic curve is also tangential to the surface, as was obvious in the case of the regulus. The figure below shows a set of horizontal spirals defining a path curve surface, and two of the asymptotic curves are shown, one of each type:

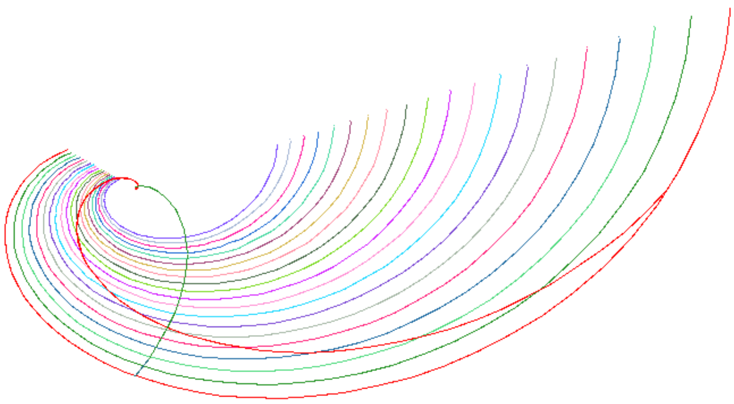

Figure 4

Asymptotic curves are described in Ref. 4 with special reference to asymptotic path curves. It is shown there that given two suitably related values of λ it is possible to find a surface defined by μ and β with asymptotic path curves having those λ-values. If these are λ_1 and λ_2 then it is shown that

$$\beta^2 = \frac{-(\lambda_1 - \lambda_2)^2}{2(\lambda_1 + \lambda_2)(\lambda_1 + 1)(\lambda_2 + 1)} \quad (2)$$

$$\mu = \frac{2\lambda_1\lambda_2 + \lambda_1 + \lambda_2}{\lambda_1 + \lambda_2 + 2} \quad (3)$$

The denominator in (2) must be negative for real β so that either

$\lambda_1 < -1$ and $\lambda_2 < -1$
or $-\lambda_1 < \lambda_2 < -1$
or $-1 < \lambda_2 < -\lambda_1$
or $1 < -\lambda_1 < \lambda_2$

The two λs must be chosen accordingly, at least one being negative.

Flowform Design

The biodynamic preparations are made using various ingredients together with water and cow horns. A water vortex profile approaches closely a vortex path curve, especially near the top, with λ=-2.9 on average (Ref. 2), and a cow horn has curves in its surface which were determined by the author to be path curves with λ=-1.5. Substituting these two values in equations (2) and (3) gives μ=-1.792 and β=0.484. Figure 4 shows the resulting asymptotic curves and logarithmic spirals for this solution. The following figure shows an impression of the surface for a 15cm drop in height:

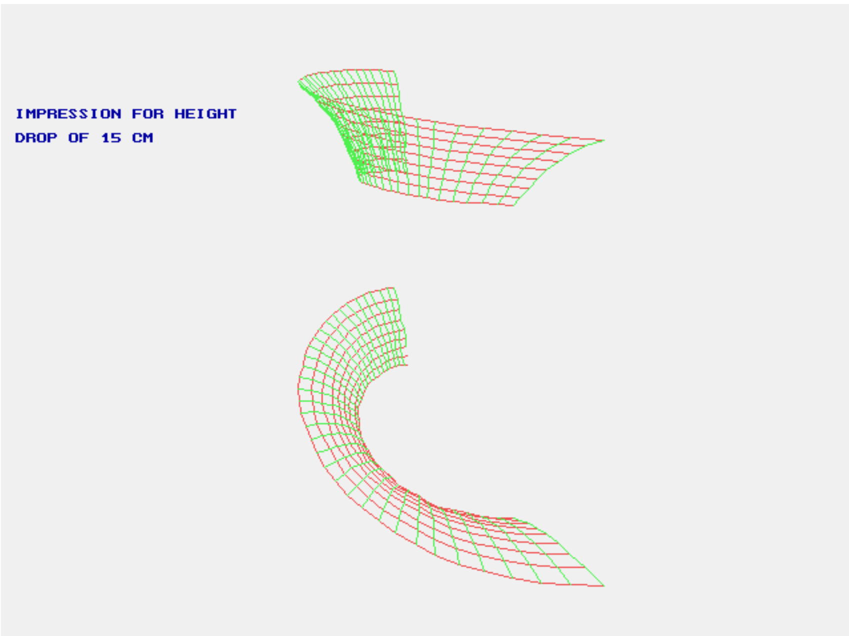

Figure 5

while the diagram below shows how a portion of the surface was used four times to design the actual Flowform:

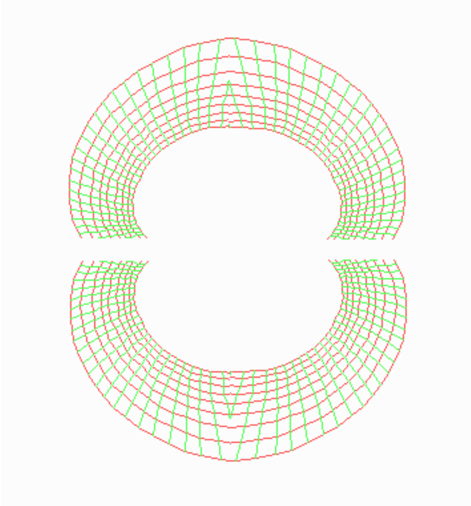

Figure 6

Programs developed by the author enabled the above design work to be carried out, and the spatial coordinates to be extracted for making the required templates for the actual construction.

Conclusion

The idea of the author to derive a surface from two path-curve λ-values for its two sets of asymptotic curves worked out well, and the resulting Flowform design was derived from that by John Wilkes and the author, and then the actual Flowform was made by Nick Weidmann and John Wilkes. The resulting Flowform functions well, naturally after considerable detailed sculptural work to fit the mathematical surface into a practically functioning Flowform.

The same idea could be used to design Flowforms for other uses such as mixing medicines where the λ-value of, say, a plant bud related to the medicament was used, noting that within the constraints cited one λ-value may be positive, as for a bud.

References

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4. Thomas N.C., *Asymptotic Path Curves*.
5. Thomas N.C., *Path curves*.
6. Wilkes, A. John, *Flowforms*, *the Rhythmic Power of Water* Floris Books, Edinburgh 2003.

Note: references without details are PDF documents available at http://healingwaterinstitute.org, *Mathematics* tab.