

RHEO-ART, AN APPLICATION OF FLUID DYNAMICS TO ART CREATION

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It is well known that repeated unsteady motion of walls of a container with a highly viscous fluid produces a chaotic mixing in the fluid, which is called "Lagrangian turbulence". It can be visualized by adding some dyes with the same viscosity.

The main interest in this phenomenon has been its chaotic behavior as a result of accumulation of laminar flows. In fact the resultant dye pattern is similar to the Poincare map of chaotic dynamical system.

On the other hand, this mixing pattern is often very beautiful and impressive, so that it is attracting people not only in scientific field, but also in design and art.

The purpose of this paper is to propose a new field of research to investigate how artworks come out from observation of fluid dynamics. To begin with, two circular cylinders are set vertically in a viscous fluid filled in a container. They are rotated by certain angles, not simultaneously but in turn. Then, they are rotated in turn in the opposite sense. These four rotations constitute one step of operation. After several repetitions of this operation we have a chaotic but beautiful patterns. It is worth noting that these patterns have a certain regularity and a break of symmetry. The symmetry breaking is owing to the process where one of the cylinders is rotated first. Similar processes are tried for four cylinder case and others.

Analogous operation is possible in the 3D space. Two cylinders in distortion configuration are rotated by a certain angle in turn, where a spherical dye is placed in the mid-point of the two cylinders. After repetitions of the operation, the dyed region is deformed gradually to interesting forms. Its perspective views until 9 steps of operation are shown. An attempt was made to reproduce the form at the 9-th step as a solid model with the help of a sculpture artist. After that the artist made another solid model inspired by this model. It is noted that the first model is an outcome of natural law, in a sense that artificial control is confined only to selections of parameters (rotation angle and initial shape of the dye). On the other hand, the artist's work is hand made, where all kinds of modulations are possible during creation. There are some characteristic differences between these models.

This trial is considered to suggest a new method to create art, and at the same time to propose problems what is the difference between art work and scientific work, and how the art and the science give positive influences each other.