Numeri, geometria, arte

Francesco Tampieri
ISAC CNR, Bologna
f.tampieri@isac.cnr.it; francesco.tampieri@unibo.it
http://bolchem.isac.cnr.it/lecture_notes.do

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Il linguaggio della ricerca

www.bo.cnr.it/linguaggiodellaricerca/

I numeri

I numeri interi: 1, 2, 3, 4, 5, 6, ...

$$F_n = F_{n-1} + 1$$

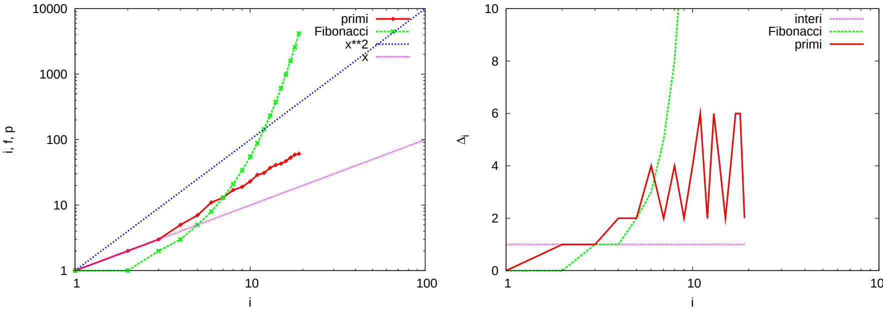
La serie di Fibonacci: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

$$F_n = F_{n-1} + F_{n-2}$$

I numeri primi: 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, ...

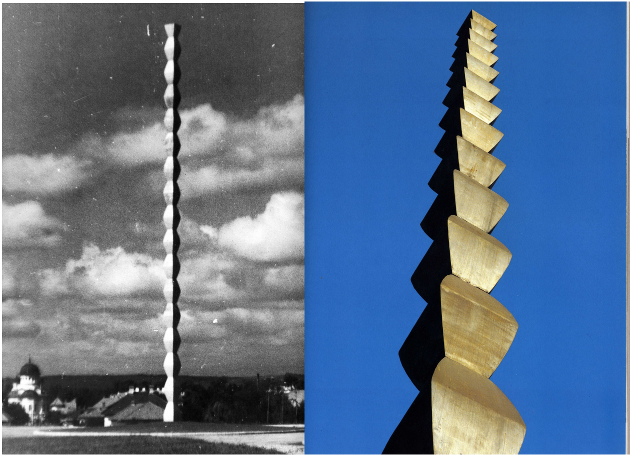
$$F_n = ?$$

ancora numeri



numeri e tempo: Roman Opalka

infinito: Constantin Brancusi



La colonna senza fine di Brancusi a Targu Jiu

Il volo dei numeri, Mario Merz - Mole Antonelliana

Ancora sui numeri primi

Finding the **prime** suspect

Marcus du Sautoy recounts his experience talking about numbers with some criminal masterminds.

"It is said that the average IQ inside Her Majesty's prisons is above the national average. Recently I got the chance to put this to the test: a member of the Independent Monitoring Board attended a talk I gave as part of my PPA award, and asked if I'd like to talk to inmates at Reading Gaol about prime numbers."

READING GAOL is famous for its literary output, but the chance to stimulate a mathematical Oscar Wilde seemed an interesting challenge. The history of mathematics is full of examples of breakthroughs (rather than breakouts) by mathematicians in prison. So I thought their stories might stimulate others to find some escapism in the world of numbers.

Reading is currently a young offenders institute for 18-21 year olds. Although listed as category C, there are some pretty serious criminals locked inside the Victorian edifice. It was a daunting prospect to address murderers about mathematics.

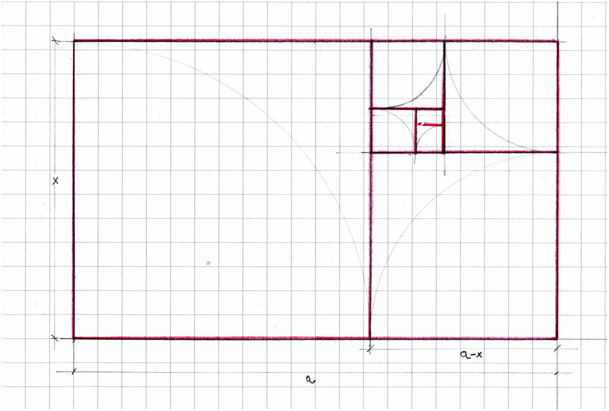
The fact that I got through to a couple of inmates was worth the disinterest of those just happy to spend an hour out of their cells. Several prisoners couldn't believe you could win $100,000 for finding a ten million digit prime, or that internet hacking depends on prime numbers. The prison officers weren't too sure about encouraging more criminal behaviour in their inmates.

The constant movement of inmates between prisons makes continued education almost impossible for the prison service to deliver. But my contact at Reading Gaol said that a week later three prisoners were still discussing several of the problems I left them with over lunch. I may not have provided them with the skills to unlock their cells, but hopefully they got something to unlock their minds.

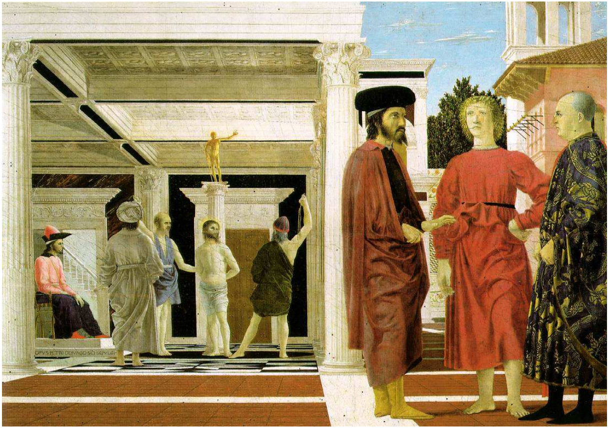
Marcus du Sautoy, Professor of mathematics at the University of Oxford, has recently been appointed an EPSRC Senior Media Fellow. Contact: **dusautoy@maths.ox.ac.uk**

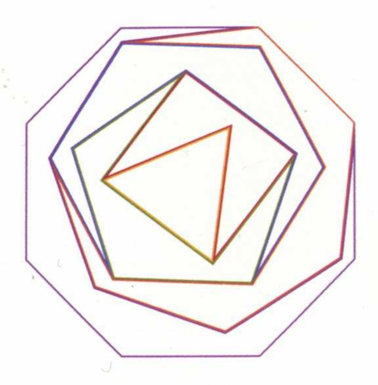
La sezione aurea

La sezione aurea x di un segmento di lunghezza a e' definita come il medio proporzionale tra a stesso e la differenza $a - x$:
$a : x = x : (a - x)$

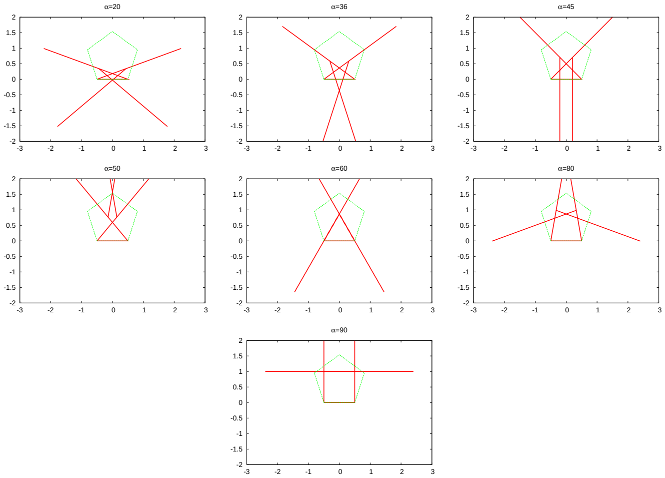


Piero (1469)



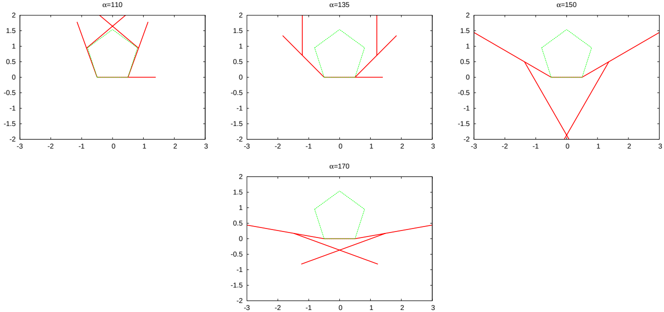


l'evoluzione del pentagono: Saffaro



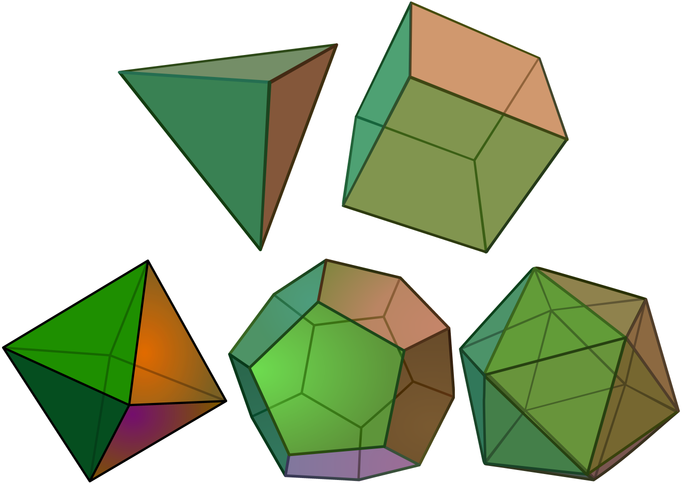
$S = 180\ (N-2)$; regolare: $\alpha = S/N$; isoscele $\beta = S - \alpha\ (N-1)$

ancora pentagoni e Saffaro



$S = 180\ (N-2)$; regolare: $\alpha = S/N$; isoscele $\beta = S - \alpha\ (N-1)$

Poliedri platonici

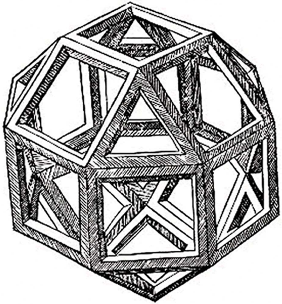


I cinque poliedri regolari ordinari.

Luca Pacioli

Painting of Luca Pacioli, attributed to Jacopo de' Barbari, 1495. Table is filled with geometrical tools: slate, chalk, compass, a dodecahedron model. A rhombicuboctahedron half-filled with water is suspended from the ceiling. Pacioli is demonstrating a theorem by Euclid.

Il rombocubottaedro



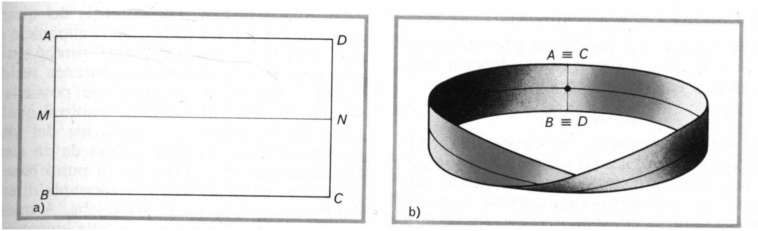
Leonardo. Il rombocubottaedro. Illustrazione per il libro di Luca Pacioli, *De divina proportione*, 1509.

Poliedri eleganti: Saffaro

La stella di Origene (opus CCXCCII) olio su tela, cm 80 $\times$ 60, 1991. Fondazione Saffaro, Bologna.

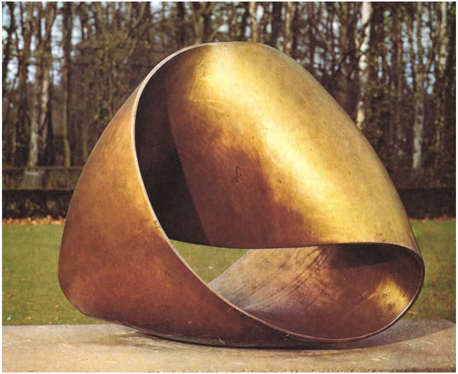
Duo-colour Double Polyhedron Lamp, 2011.

Superfici unilatere: Moebius

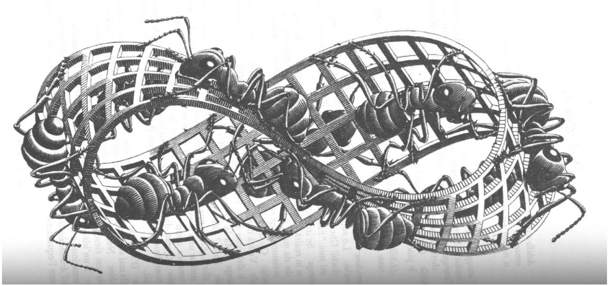


Nastro di Moebius

Superfici unilatere: Max Bill



Max Bill. Endless torsion. 1953-1956. (Bronzo, $125 \times 125 \times 80\,\mathrm{cm}$. Antwerpen).



M. C. Escher. Nastro di Moebius. Xilografia su legno di testa a tre colori, 1963.

RANS (1)

$$u_i = \overline{u_i} + u_i' \tag{1}$$

$$\frac{\mathrm{D}\overline{u_i}}{\mathrm{D}t} \equiv \frac{\partial \overline{u_i}}{\partial t} + \overline{u_j}\frac{\partial \overline{u_i}}{\partial x_j} = -\frac{1}{\rho_{00}}\frac{\partial \overline{p}}{\partial x_i} + \varepsilon_{ij3} f \partial u_j + \nu \frac{\partial^2 \overline{u_i}}{\partial x_j \partial x_j} - \delta_{i3}\frac{g}{\rho_{00}}\rho - \frac{\partial \overline{u_i' u_j'}}{\partial x_j} \tag{2}$$

$$\frac{\partial \overline{u_i}}{\partial x_i} = 0 \tag{3}$$

$$\frac{\mathrm{D}\overline{\theta}}{\mathrm{D}t} \equiv \frac{\partial \overline{\theta}}{\partial t} + \overline{u_j}\frac{\partial \overline{\theta}}{\partial x_j} = \chi \frac{\partial^2 \overline{\theta}}{\partial x_j \partial x_j} - \frac{\partial \overline{u_j' \theta'}}{\partial x_j} \tag{4}$$

$$\frac{\mathrm{D}\overline{u_i' u_k'}}{\mathrm{D}t} \equiv \frac{\partial \overline{u_i' u_j'}}{\partial t} + \overline{u_j}\frac{\partial \overline{u_i' u_j'}}{\partial x_j}$$

$$\begin{aligned}
= \quad & (-\overline{u_i' u_j'}\frac{\partial \overline{u_k}}{\partial x_j} - \overline{u_k' u_j'}\frac{\partial \overline{u_i}}{\partial x_j}) - \frac{\partial \overline{u_i' u_j' u_k'}}{\partial x_j} \\
- \quad & \frac{g}{\rho_{00}}(\delta_{k3}\overline{u_i'\rho'} + \delta_{i3}\overline{u_k'\rho'}) + f(\varepsilon_{kj3}\overline{u_i' u_j'} + \varepsilon_{ij3}\overline{u_k' u_j'}) \\
- \quad & \frac{1}{\rho_{00}}(\frac{\partial \overline{p' u_k'}}{\partial x_i} + \frac{\partial \overline{p' u_i'}}{\partial x_k}) - \overline{\frac{p'}{\rho_{00}}(\frac{\partial u_i'}{\partial x_k} + \frac{\partial u_k'}{\partial x_i})} \\
+ \quad & \nu(\overline{u_k'\frac{\partial^2 u_i'}{\partial x_j \partial x_j}} + \overline{u_i'\frac{\partial^2 u_k'}{\partial x_j \partial x_j}}) \qquad (5)
\end{aligned}$$

Vortici 'numerici'

102 B.L. Hua, P. Klein / Physica D 113 (1998) 98–110

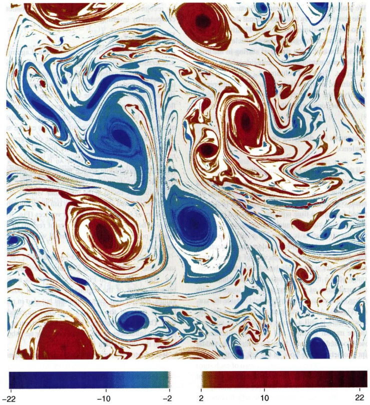
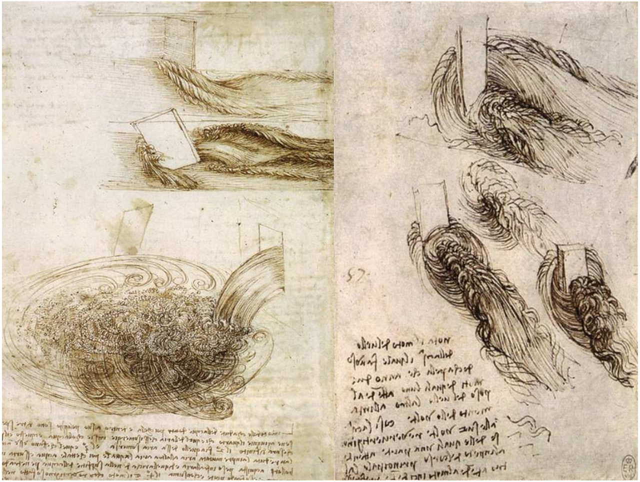


Fig. 1. Field of vorticity ω after 40 turnover timescales for a 1024×1024 simulation of decaying turbulence.

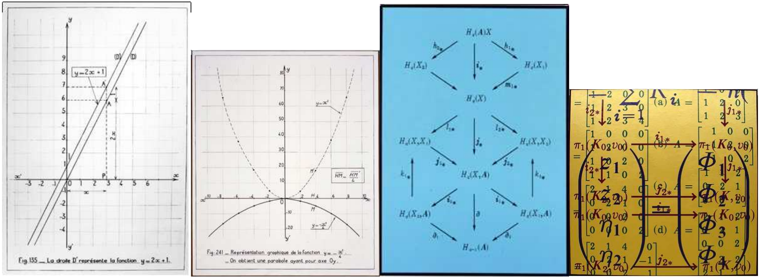
Simulazione numerica di un flusso turbolento.

Vortici 'leonardeschi'



Esempi di flusso di acqua, di Leonardo.

Formule 'decorative'



Bernar Venet. Opere dal 1966 al 2004.

Computergrafica *vs* arte

His simulated reality seems so perfect that only on second sight what seems like nature gets exposed as fiction.

L.movi, 2011.

Reas' software and images are derived from short text instructions explaining processes which define networks.

Process 16 (**Software 3**). 2012.

Diego Zuelli (Reggio Emilia, 1979)

A software continuosly recombine some elements to provide infinitely diverse combinations of rings, planets, light conditions and movements. The sound score is random generated as well: a bandoneon plays notes and chords following only a few timing rules.

Il complesso dei pianeti, 2013.