SP\_ACE AND FORM: An interdisciplinary course for the 5th year of students of Mathematics and of Industrial Design

Place: Math Department “G. Castelnuovo”, Università di Roma “La Sapienza”, Piazzale A. Moro, 00185 Rome, Italy

Teacher: professor Michele Emmer, emmer@mat.uniroma1.it; http://www.mat.uniroma1.it/people/emmer

Academic Year: 2009-2010

Duration: end of February-mid June, every year
45 Hours of lessons

Idea of the course

This interdisciplinary course gives details on how the idea of Space has been changing over the last 150 years and how the new ideas on Space had a large influence on our culture: visual arts, literature, architecture, design, plastic arts, leading to the creation of new forms that are interesting both from the scientific and the artistic point of view.

The course is intended for the last year of the specialistic degree (3+ 2 years) in mathematics but it can be of interest also to the students of the first three years of the masters degree. Students in architecture, philosophy, art, and design are welcome. Of course exams will be different depending on the curriculum of the students.

The course uses an array of visual equipments including computers, DVD, Internet. Short stage in a Computer animation factory.

List of possible topics:

* The Idea of Space: new geometries, evolution of the idea of space, the influence on the artistic avant-gardes of the beginning of the XX century, including architecture. The idea of transformation, metamorphosis, including the projects exposed at the Biennale of Architecture in Venice, 2008.

* Regular Shapes in three dimensions, from the “Thimaeus” of Plato to the rediscovery of the Regular solids during the Renaissance. Luca Pacioli, Piero della Francesca to Kepler. Semi regular, Catalan, star shaped solids. The mathematical structures of Lucio Saffaro.

* The Fourth Dimension form the first approach in “Flatland” to Coxeter’s Polytopes in four dimensions to virtual architecture. Influences on visual art, plastic art, architecture in the XX century, Buckminster Fuller.
* The importance of Topology: starting from the Moebius band to the first examples of topological surfaces, till the use in the field of art and architecture (Max Bill, Bruno Munari, Eiseman, van Berkel, Ghery, BIG).

* The technique of computer animation: 3D animation and 2D animation in cinema and in geometry, in cooperation with Gian Marco Todesco, Digital Video. (It will be possible to visit his lab)

* Symmetry crystallographic groups, generators: classification and tessellations. Application to mosaics in different cultures in various periods. Asymmetric structures, Penrose and Quasi crystals.

* Mathematical structures in the art of M. C. Escher. Symmetries, non Euclidean geometries, the cooperation with Coxeter and Penrose. The impossible objects. Animation of Escher's works, using cinema.


* The relationships between mathematics and cinema, including theatre with many visual examples, using many films and plays.

* A very interesting case: curves. The history of the discovery of the various curves. Their equations and their evolution in the arts. Their importance in Design.

* Fractals: from the algorithms of Mandelbrot till the study of attractors and thier simulation.

* Mathematics and literature. How mathematics has influenced writers starting from the XIX century. The models and their use.

**Bibliography:**

M. Emmer, ed. the series of volumes “Mathematics and Culture”, Springer.
M. Emmer, the series of DVD on “Art and Mathematics”