RRRTEA '04

[RESTORATION, RECYCLING AND REJUVENATION TECHNOLOGY FOR ENGINEERING AND ARCHITECTURE APPLICATION]

Up-to-date knowledge related structure reinforcement, protection, life extension and environment consideration

Proceedings of the International Conference of Restoration, Recycling and Rejuvenation Technology for Engineering and Architecture Application held in Cesena, Italy, June 7-11, 2004

Edited by

G.C. Sih[a,b]
[a]Lehigh University, Bethlehem, USA
[b]East China University of Science and Technology, Shanghai,China

L. Nobile
Alma Mater Studiorum-University of Bologna
Bologna,Italy

www.aracne–editrice.it
info@aracne–editrice.it

00173 Roma
via Raffaele Garofalo, 133 A/B
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Foreword

Of all the changes around the globe since mankind, the depletion of natural resources and deterioration of the environment are invariably the two outstanding concerns barring from unpredictable natural disasters that may strike without warning. A sense of false security has always been with people at large that the man-created problems will somehow take care of themselves or disappear in time. But this obviously will not be the case. The concept of "globalization" be it in science and technology, governance or environment is suppose to unite the world and to create partnerships on an equal footing, however, defined in an effort to establish priorities for seeking possible remedies, not to mention finding solutions which might be too much to hope for. The idea of the present international conference was borne from a group of material scientists and mechanists who work in mesomechanics and became concerned with
their research in connection with the environment which is clearly expressed by the theme of restoration, recycling and rejuvenation of structures and materials as influenced by modern technology. There is no better location than the city of Cesena being near the cities of Bologna, Florence, Venice and others being rich in historical monuments and buildings, the structural integrity of which may become vulnerable to the changing modern environments. Advancements in light weight and high strength composites together with highly effective processing techniques can no doubt improve the restoration of intricate structures with saving in cost and time.

Extracting precious metals from retired computers and machines and their recycling know-how are also of great concern from protecting the environment point of view. Future automobiles will no doubt be designed with the recycling of parts taken into account. Replacement of persistent pollutant materials is becoming if not already a major issue as stringent requirements will be placed on their disposal. A better understanding of the mechanisms that govern aging and/or rejuvenation of materials could enhance the life expectancy of high performance devices and to avoid premature retirement. There is the general feeling that much more can be done if the physical models of materials were to include the influence of microstructure entities, namely strengthen materials with micro- or nano-size reinforcements if the technology can be made cost effective. Such objectives are not unattainable as the more advanced materials are fabricated in sufficiently large volumes. It is also the belief of the organizing committee that researchers from a variety of background would

be effective when they are brought together with a common goal to achieve. The sharing of knowledge can be an invaluable experience. It can be seen from the technical program and the papers presented in this volume that progress concerning the restoration, recycling and rejuvenation of materials is already on the way. It is anticipated that additional advancements in the areas of

- Cause for retirement to minimize unexpected failure of high performance structures.
- Knowledge-based inspection and maintenance procedures to avoid disruption of continuous operations.
- Restoration know-how of aged buildings and structures to extend the design lives.
- Design of assembled structures to facilitate dismantling.
- Surface coating to protect material bulk properties.
- Repair technology for concrete, composite and metal.
- Additives for the reinforcement of microstructures.
- Aging and rejuvenation mechanisms for metals and polymers.
- Degradation of materials caused by environment.
- Non-destructive testing methods.
- Damage sensing and evaluation.
- Protection of environment and structure from natural disasters.
- Accelerated testing for long time effects.
- Replacement of persistent pollutants.
- Recycling of precise metals and machine parts.• Life extension of aged structures and components.
- Tensegrity structure: related to biology, mathematics, large structures and models in mechanics.

will further enhance the more efficient use of natural resources and maintain a viable environment. This is a continuing task that must be kept in mind by the community at large.

On behalf of the organizing community, the Co-Chairmen would like to extend their gratitude to the contributors who have made the publication of this volume possible. A special note of thanks is also due to the members of the local organizing committee members, especially to Dr. Christian Carloni, who have spent endless hours to make the conference run smoothly.

Cesena, Italy G. C. Sih
June 7-11, 2004 L. Nobile

Table of Contents

SECTION III – ADVANCED MATERIALS AND TESTING METHODS

SECTION IV – LIFE ENHANCEMENT AND IMPEDIMENT

SECTION V – WASTE TREATMENT AND RECYCLING

SECTION VI – ROCK AND MASONRY

SECTION I – ENVIRONMENT EFFECTS

SURVIVE WITH THE TIME O'CLOCK OF NATURE

George C. Sih[a,b]
[a] School of Mechanical Engineering, East China University of Science and Technology, Shanghai 200237, China
[b] Department of Mechanical Engineering and Mechanics, Lehigh University, Bethlehem PA 18015, USA

Abstract

The industrialization of science and recovery of the cost of its investment have been debated in recent decades with reference to the overall merit of the human society. Whether scientific inquiries must be justified on the basis of commitments made to bear fruit or simply because of curiosity and desire to learn, the trend has favored the former. It does appear that the generalization of Aristotle that "all men by nature desire to know" has been challenged by the force of quest for financial gain. Investment and return is deeply embedded in to-day's scientific development and often at the expense of the environment. Greenhouse effects, pollutants found in human bodies, virus destroying living cells, etc. are just some of the undesirable consequences. Check and balance provided by the process of equilibrium in nature have apparently been provoked. The objective of this discussion is not concerned with the abuse of scientific knowledge but rather to inquire into the ways with which science could perhaps develop a model to learn more about the process of evolution. The basic premise of this work is that nature follows a time table by which all matters change following a pre-determined course. Accordingly, the development of the human cells would also change its structure and follow this time table congruent to the fixed amount of available energy in the expanding universe.

The natural human instinct would therefore be directed toward a better understanding of the environment enhancing survival however defined. Predictions beyond human experience are comforting for they can provide ways for remedies if action for recourse is discovered in time. Such concerns related to environment have received attention in recent time although not to the consensus of the world community at large. There are evidence of warming of the climate deviating from the norm in the past, discovering new virus that humans have yet developed immune resistance, increasing conflicts among nations caused by unbalanced wealth in resources, and more alarming is the lacking of willingness to improve these ill-conditions when they have already been identified. It would be unrealistic not to say that these mentally and materially related upsetting events are not unrelated. The driving force directing human endeavors may well initiate from mental and material energy source that feeds on one another in cycle. There is no reason why events observed at the very large cosmic scale of 10^{29} cm in size and 10^{18} sec in time could not be related to those at the very small scale of 10^{-13} cm for light crossing a nucleus radius at 10^{-24} sec.

Optimistically speaking, it is not totally inconceivable that the growth behavior of human cells may be predicted from the organization of the constituents such as organelles and molecules. The key is how to unravel this complex process in a consistent fashion from a single model linking the

mechanisms of cyclic gene mutation to environmental changes. To this end, the human body can be viewed as a hierarchy of organized systems within systems from molecules to organelles (cellular components), to cells, to tissues, to organs and to human bodies such that all of the components and subcomponents can be constructed using a common form of architecture that can be modeled mathematically. The concept of "tensegrity" will be explored in connection with this possibility.

In what follows, comments will be made on the present cosmos model derived from Newtonian mechanics considerations for the lumped mass system in relation to the continuum mechanics system for deformable bodies. The Newtonian approach incidentally gives the identical results as those found from the general relativity theory if the mass density is interpreted as the total energy density divided by the square of the speed of light. In particular, the similarities of the assumptions in particle and continuum models are discussed in relation to energy dissipation and interaction of neighboring bodies. Pseudo inhomogeneity is invoked by assuming that the density of the medium depends only on the distance. Ideas borrowed from mesomechanics provide the possibility to extend the range of applicability of the continuum model. This may be accomplished by introducing characteristic length parameters such that results from two successive scale ranges can be connected using an invariant scale shifting criterion. In this way, the range of size and time scales can be extended step by step from the very large to the very small with the hope that information can be gained on changes of cell growth due to environment. Needless to say that molecular biology has already advanced to the stage where genomes can be manipulated to alter embryonic development. This is a step in the direction to learn how human behavior dictated by the brain cells can be affected by the environment. Discoveries on the intricate ways of how insects would capture their preys by mechanisms resembling modern warfare serve as evidence of genetic revolution driven by self preservation. The same should apply to the human race unless self destruction stands in the way. At present, the human brain cells seem to be directed toward the narcissistic quest for power. Domination by war appears to be the only decision for survival. Whether this is caused by defects in the mutation of human cells due to ill conditions of the environment or not remains to be seen.

Keywords: Time and Size Interaction; Cosmo to Elementary particles; Environment Issues; Invariant Scale Shifting Criterion; Time Rate Change of Energy Density Factor; Homogeneity and Isotropy; Science and Survival.

1. Introduction.

The driving force to understand nature through scientific means has changed dramatically in contemporary times as contrasted with that in the visions of the Galileos, the Newtons and the Einsteins. Curiosity was then sufficient to pursue questions such as the nature of resistance offered by natural bodies and the nature of motion. These seemingly obvious questions have led to the general theory of relativity, quantum gravitational theory and surely many more of yet developed theories. In recent times, there are concerns with regard to the pursuit of science as a human enterprise which has led to social, political and economic unrest around the world. Among these issues, environment emerged as a major theme. While progress to control the greenhouse gases and to phase out stratospheric chlorofluorocarbons (CFCs) have received international agreement, there are a host of other problems that may be more detrimental to the environment although they are not readily identified. Even though the Kyoto Protocol has gathered momentum among the members of the United Nations, international consensus