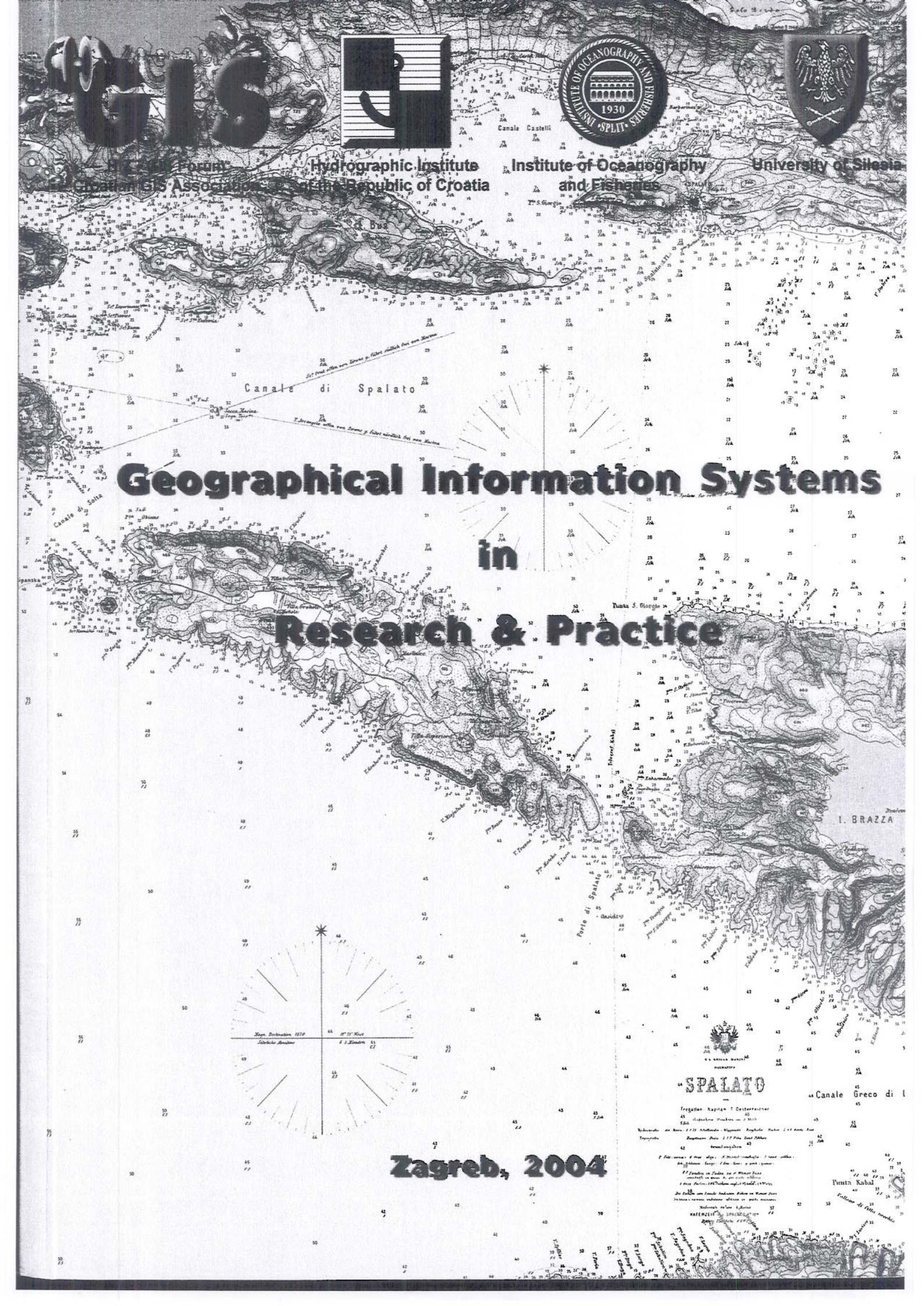

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BIS MACHINE

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Abstract:
„BIS Machine" method is an new solution in cultural and natural heritage reconstruction and management.This sofisticated integral system of new technologies is usefull in production ,reproduction, research and protection of culture and nature monuments.

„In York, year1994th, during the conference dedicated to Sarajevo post-war reconstruction,
I had a chance to present new technologies application experience in the Croatian reconstruction projects.On that occasion I said that" likely near future will be characterized by the computer-processed and robot-designed elements of monuments heritage ". It took place relatively long time ago -10 years - and participants understood it as a joke or fantasy."-D.K

Introduction

Care of society and individuals for the monuments and cultural property heritage is, today more than ever before, a picture of attitude toward our own and world cultural identity. Inherited traditional material values, managed by us on behalf of our and forthcoming generations represent stamina of the national , artistic and other creative formation being a composite of nation spirit and time.

Quality monuments heritage management is the question of maintaining spiritual substance of nation and climate. However, it is , at the same time , concern for numerous space elements being an interests focus i.e. aim of sightseeing, visits as well as researches of experts, guests, tourists and ordinary citizens. Modern and profitable tourism is today developed in countries , cities and regions characterized by large and numerous objects of ancient times, Middle Age, Renaissance and other periods. Centres of artistic creation, museums, galleries, castles, shrines, treasuries of artistic property and many other facilities of artistic heritage became generators of millions of tourist migrations and visits. Some cities, apart from significant tourism incomes, have problems with mass visits paid to various centres and sights of interests for domestic and foreign visitors.

New cultural property demands and pleasure visions occurred are incorporated by reconstruction problems as a composite and very important element.

Specific monumental reconstruction and protection problems

Monumental heritage and culture monuments restoration are long-term, outstanding complex, demanding and expensive processes. Very often being in the situation that in spite of strong desire and quality designs we are not able to operate some restoration designs of especially important objects, priority construction and sculpture heritage.

Shortage of money, time and various profile specialists starting from craftsmen to top quality specialists in the ancient monuments work, limit broader and faster operations of some objects. We are witnesses that some designs can't be incorporated in the given frames of profession, time, money and other aggravating circumstances. The last few decades have been characterized by some centres emerged where specialists of monument properties restoration are educated. Professional workshops for renewal of tapestry, architectural plastics, wood, paper documents etc. are specialized centres essential for quality renewal and restoration of monumental heritage.

Unfortunately some valuable objects can not be improved or renewed due to lack of either experts , craftsmen or some unfamiliar technology of developing material the object is made of or application procedure. The reconstruction problems were especially recognized after the Second World War when many cities suffered a lot with completely or partially destroyed numerous valuable mobile and stationary monuments of culture i.e. heritage. Some towns were destroyed to the ground. Based on these terrible experiences specialized preservationist disciplines for some monumental heritage types were developed.
In the period 1991 – 1995 the Republic of Croatia suffered numerous destructions leaving unsolved problems of many valuable monumental heritage objects.
War destructions, natural disasters, vandalism and ageing are main reasons requiring permanent and quality conservationist's care for culture monuments. Croatia, being rich in artefacts and works of art starting with pre-history via ancient time , Middle Ages, Romanesque, Renaissance to XXI century, requires modern methods of preservation, improvements of financial conditions and objects reconstruction such as „BIS Machine" system is .

„BIS Machine" system

In the domain of geoinformatics, computer sciences and integrated technologies, this cooperation contributed to the authors' solution creation being defined as a new method of culture monuments restoration entitled "BIS Machine" which will be presented in the our paper.

This experience and method is the result of cooperation and research of numerous experts from domain of culture monuments restoration and protection from Poland, Croatia, Great Britain and many other countries. Also, thanks go to all subjects for the cooperation, especially to the universities Polytechnika from Cracow-Institute of history of architecture and monument preservation, AGH from Cracow and Polytechnika from Warsaw, Warsaw institutions, National Library from warsaw and to faculties and institutions from Sosnowiec, Katowice and whole Silesia and Gdansk.

The origin of „BIS Machine" we dated in the year 1994th when autor sugested division of geoinformatics in 3 level from the precision point of view:

Macro level: operating graphic data in scale 1: 100.00,1:200.000 and others for state and regional analysis;

Mezzo level: operating graphic data in scale 1:5000 to 1:50.000 and similar for municipal and small area analysis;

Micro level: operating graphic data in scale 1:1000, 1:100 and other scales for one building or object analysis even in the scale 100:1 or larger caled Building Informaton System-BIS.

BIS machine is a new system used at developing parts or the whole of stationary and mobile culture and nature monuments as well as other objects from nature , human body structure and productive and research environment.

This complex method is applied in developing and reconstructing parts or wholes of culture monuments, works of art and other required objects.
All mentioned elements, parts and the like will be called "objects" in further text.

Technical problem

Culture monument reconstruction or development of the parts or whole of new works of art i.e. objects made of stone , synthetic material, wood, salt, metal, natural materials and the like demands very long terms ,basically manual work, special creativity and questioned work preciseness. Developing of some objects is often impossible due to lack of artists, stone-masons, craftsmen and the like. Problem of knowledge and long development terms as well as additional funds appear to be limiting factors of the objects development reconstruction.

Thus, specialist resources such as sculptors, stone-masons, model constructors, craftsmen and others are getting fewer whereby processes of reconstruction, restoration or objects development are long term and expensive, often impossible to be done.

The present status

Reconstruction and development of the objects in terms of culture monuments reconstruction processes are today based on manual work with minimum aid of simple hand-operated tools. Shaping of stone, metal, wood or synthetic mass objects is limited regarding developing speed, precision and work price.

Description of the system and work process flow diagram

Phase I

1. Object selection
2. Object shooting harmonized with requirements and possibilities (boundaries) by measuring, D scanning, photo-grammetrically, digitally analogically or using combination of the aforesaid data entry methods
3. Processing of the taken quantified data
4. Developing of quantification reports
5. Formation of the virtual object i.e. digital file etalon
6. Data direction and harmonization

Phase II

7. CAD preparation
8. CAD model development
9. Validation and etalon calibration
10. Re-design - if necessary
11. Prototyped model development (rapid prototyping – 3 D printing and the like)

Phase III

12. CAM program development
13. Material selection
14. Selection of machine and tool
15. Computer development simulation
16. Machine or device-developed production
17. Validation of the developed object
18. CAM program finishing, if needed
19. Sorting and saving all data systematized for data base
20. Object delivery and fitting

Advantages of BIS Machine

1. Precision
2. Significantly shorter development terms
3. Simplicity
4. Transparency in all project development phases
5. Lower development prices
6. Possibility of quality objects development i.e. not existing object parts
7. Data base formation and infinite replication possibility
8. Possibility to provide data capture without physical damage on objects surface

Today, due to coincidences and friendship, we are in situation to present in detail the new method conception of culture monuments restoration "BIS Machine" as well as two projects known for integrated existing knowledge and associated technologies. First example, originated from Saint Mary church restoration project from Voćin,Eastern Slawonia, destroyed during the 1991st war attack, is characterized by already prepared 3D model and a part of the main machine-designed portal in 1:2 scale.
That project showed us basic dilemmas and problems that should be solved in a broader application of the new restoration system.

Second example is far more complicated. It is about antique sculpture entitled "Apoxiomenos", excavated from the sea in 1999th near Losinj island, in the Northern Adriatic. The sculpture of 192 cm height originated from the period between Classical Greece and Helenism in the 4th century BC and represents one of the masterpieces of world cultural heritage.

Having been restored and preserved, the sculpture was presented in public whereas the author's team of the method "BIS Machine" had chance to verify the offered abilities of the new method on a very complex sculpture.
Our Apoxuiomenos, the Greek masterpiece of the fascinating beauty represents a real challenge for our new method application. How successful we were will be shown.

An New Field of Geoinformatics - Micro geoinformatics

These projects brought about completely new field of geo-informatics i.e. micro-geo-informatics as a new research and practical option for applied geodesy, ancient monuments profession, computer sciences and all integrated technologies and knowledge.

After this experiment with Apoxiomenos head, in which we processed points and graphic data in precision of 0,10 mm and higher, it possible to sugest a new solutions in geoinformatics environment – Microgeoinformatics!
Please note that only for Apoxiomenos head we used „clouds of points" larger than
1 million captured points x,y & z.

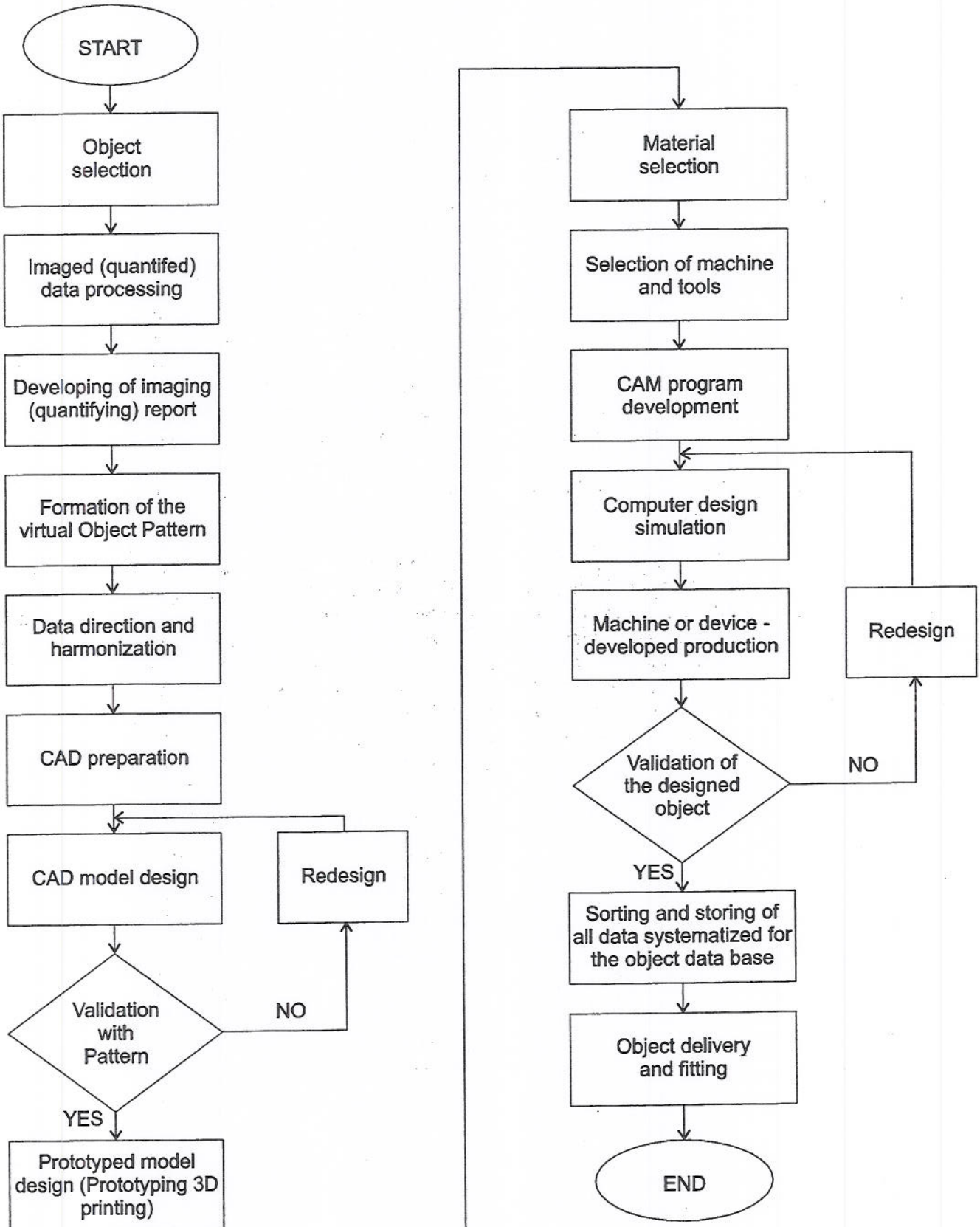
Aiming to illustrate multidisciplinary being a basis of this new method, we merge experiences and knowledge of the professions and activities as follows:

Ancient monuments profession, culture monuments restoration
Production of cars, ships and airplanes
Metal industry in general
Blacksmith crafts
Stone –masons crafts
Carpenter's crafts
Computer modelling
Materials science
Applied geodesy
Photo-grammetry
Digital methods of data processing
Digital photo-taking
Machine-building industry
Robotics
Tool industry
Art history
Architecture
Etc.

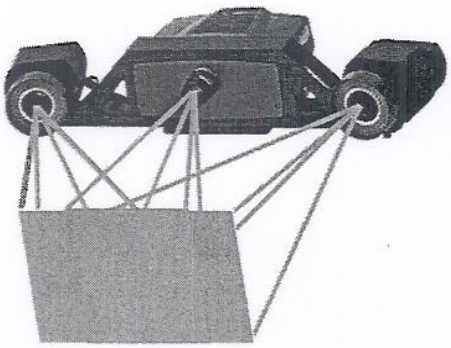
It should be pointed out once again that important roles in this method conception were played by common people, hard-working craftsmen, masters of their profession who had not been familiar with culture monuments restoration before. Thanks go to all of them!

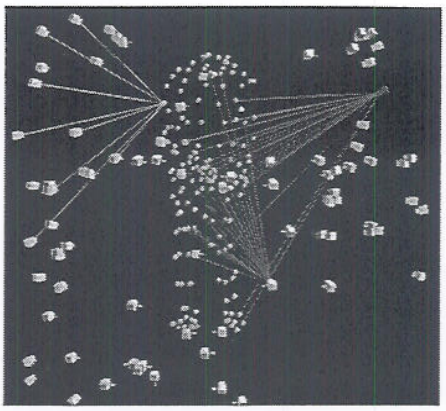
NB
The „Apoxiomenos" project is operated as scientific and technologic experiment by courtesy of Croatian Conservation Institute from Zagreb,Croatia and Topomatika d.o.o Zagreb, Croatia.
Entyre „Apoxiomenos" experiment have been provided in 2 months without any finacial support besides authors money.

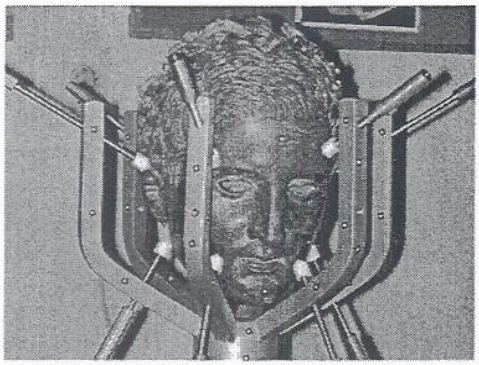
Diagram of BIS Machine method process flow

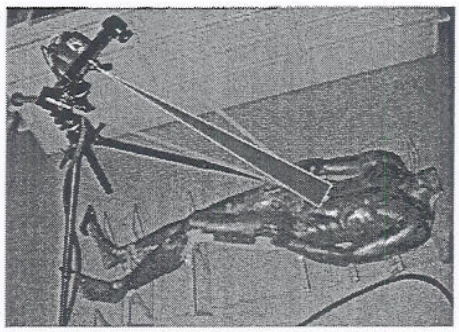


THE SECOND APPLICATION OF BIS MACHINE METHOD APOXYOMENOS PHOTO DOCUMENTATION IMAGING

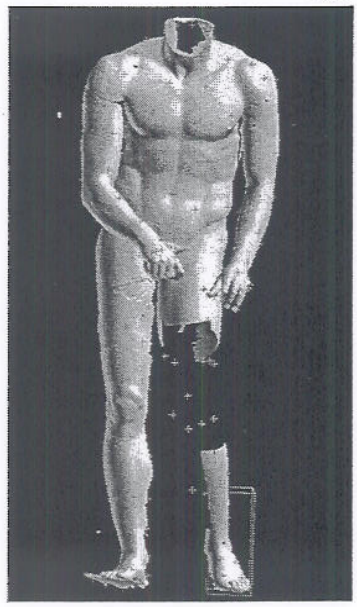


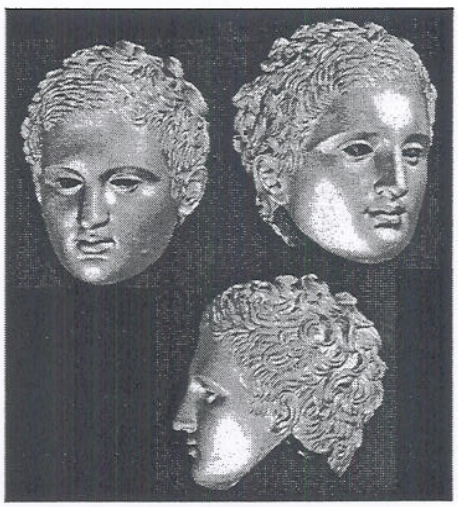






THE SECOND APPLICATION OF BIS MACHINE METHOD APOXYOMENOS PHOTO DOCUMENTATION 3D MODELLING





By Courtesy of Topomatika & Restauratorski zavod, Croatia