Knowledge Management in Interdisciplinary Scientific Research

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In the paper are presented ideas regarding the computer based methods employed to gain knowledge which were used in different fields of science. Basically, the models offer results expressed in different ways which can be converted in computer information. The synthesis of the results can be done if flexible interfaces are used and different types of analysis are employed. This integration is natural if it is not used as a final stage to gain knowledge, but from the first stages, as one of the basic concepts of the research. The wide range of important results of the interdisciplinary research along the latest 20 years confirm the effectiveness of this strategic concept.
***Keywords**: research, interdisciplinarity, data management, knowledge.*

Introduction

We live in a fast changing world with new, different and complex problems which require solutions conceived in an upper level of understanding and where the management of change is an effective instrument.
The white areas on the map of knowledge can be explored only if new means of investigation are designed. Research is the major direction which offers new information and when several fields of science offer results which can be used in an unique interdisciplinary research, a revolution is started.

Basic ideas

There are several layers of refinement of the information, with respect to the intrument of investigation employed. Figure 1 presents the correspondence between the complexity of the approach and the importance of the results. As it can be noticed the basic layer is the technology which is continuosly evolving, so the overall hirarchy is dynamic. Below technology there would be the layer of the simple observations and deductions which offer basic information considered 'noise', this layer being neglected in the figure below. The pyramidal hierarchy is just a two-dimensional representation, in fact the set of relations being far more complex. There should be also noticed that data, information and knowledge are parts of an unique and continuous unit, without disjunctive components.

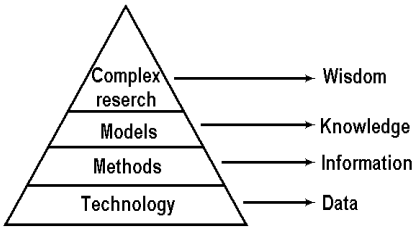

Fig.1. Hierarchy of instruments and their results

If the results of these levels of approach are used to develop the technology, a new cycle of the pursue of wisdom begins.
If we section the structure presented in figure 1 with an horizontal plane we can identify several sets of technologies, methods and models. Figure 2 presents a set of three types of models employed in engineering.

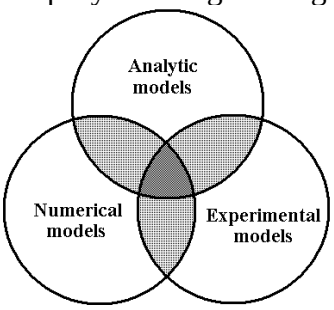

Fig.2. Types of models in engineering

Each type of model consists of several categories of lower-level models according to the specific hypotheses and the methods employed to solve the problems.
As it can be noticed, hybrid models can be also conceived, the results of the different

models being convergent for a well posed problem followed by accurate studies.

Integration of the information

All the results of the different studies must meet in a gathering area where their synergic effect offers a new perspective, an upper level of understanding.

In order to have a strategic direction right from the beginning, there must be identified the common aspects of the different types of solutions. After several studies and projects there was noticed that numerical methods, matrix based approaches and computer programming can be found in most of the fields of science. Moreover, the techniques, algorithms and software used to process matrices can be employed as a general knowhow to be used in complex approaches.

There was designed a software instrument consisting of a set of programs written in different programming languages which use a common data structure. This idea offers to the investigator the opportunity to transfer data from an environment or programming language to another environment or programming language. In this way the data processing technique uses the best features of all the programming languages considered.

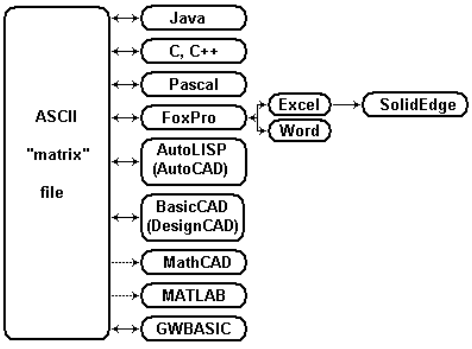

Fig.3. Data processing method based on matrices

Figure 3 presents the programming languages employed 10 years ago, which use a common data type which is a text file with a static structure, similar to a table. Each element of the matrix is a record in this ASCII file which can be accessed from any programming language.

For instance, a research project can use experimental data expressed as text files which are converted in ASCII "matrix" files. Next, these files can be used in any programming language in order to fulfill a given task. As an example, large amount of data can be processed in FoxPro and visualized in Excel; numerical methods can be used in MathCAD, MATLAB or in original software written in Pascal, C or Java; complex 3D drawings can be automatically done in CAD systems. Dynamic memory alocation and other optimizations were also designed. Even the data processing technique might look atomized, the general concept is to use all the facilities of the library of programs in order to create a dedicated and flexible instrument of investigation.

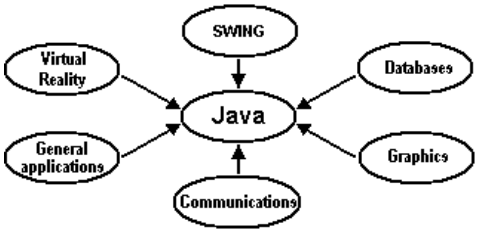

Fig.4. Programming language and a set of requirements

At present, the creation of a dedicated software is far more simple because there are programming languages whose features meet most of the requirements. Figure 4 presents the facilities of the Java programming language. Another strong point is the large number of libraries of applications which can be found over the Internet.

An interesting and relevant aspect regarding the importance of the knowledge management in research can be noticed in figure 5. Thus, all the facilities presented in figure 4 are employed in this complex model: virtual reality, communication between the remote operators, numerical models of the oil spill, databases where the changes of the scene are stored, SWING interface.

Conclusion

Even modern technologies offer new solutions consisting of accurate results presented as numbers or as graphical information, there is still a lot of work to be done in the integration of the results. The sinergy of these separate results can be used to reach an upper

level of understanding.

Software solutions were conceived in order to apply in an effective way this concept and the results are relevant and important.

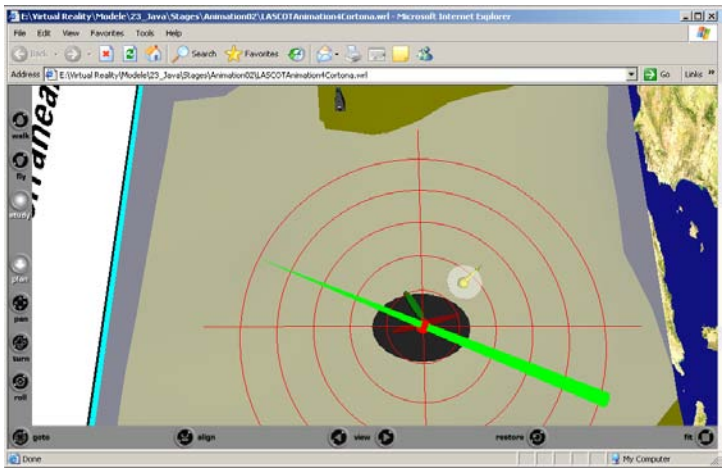

Fig.5. Oil spill virtual reality model

New software technologies offer better facilities which can be used to create libaries of software applications. Further on, these libraries can be employed to create effective research software instruments.

Interdisciplinary research requires such software approaches which are the unique solution to create complex and accurate models of our dynamic nowadays world.

References

- Oanta, E., Nicolescu, B. (1999), DETC/CIE59: A versatile PC-based method for the processing of the large matrices, 1999 ASME Design Engineering Technical Conference, September 12-15, 1999, Las Vegas, Nevada, USA
- Oanta, E. (1999), A database approach in computer aided engineering, Scientific Review of the 'Ovidius' University of Constanta, Romania, 1999, Vol. I, Pag. 253-260, ISSN 1223-7221
- Oanta, E. (2001), Study of the strains and stresses in the block of cylinders of the naval internal combustion engines, PhD Thesis, 'Cum laude', Field of science: Mechanical Engineering, 2001, Politechnica University of Bucharest, Under the scientific guidance of Acad. Prof. Dr. H. C. Constantin Arama, Member of the Romanian Science Academy
- Oanta, E., Nicolescu, B. (2004), Computer-aided approaches – a path to the information of synthesis in engineering, Proceedings of the 5th International Conference on Quality, Reliability and Maintenance – QRM2004, ISBN 1-86058-440-3, University of Oxford, UK, 1-2 April 2004, pag. 265-268
- Vucinic, D., Oanta, E., Deen, D., Zvonimir, B. (2005), LASCOT- LArge Scale COllaborative decision support Technology - An Information Technology for European Advancement Project, 2004-2005, http://www.bull.com/lascot/ , http://eoanta.fortunecity.com/20050629Research-VUB-1.gif, http://eoanta.fortunecity.com/20050629Research-VUB-2.gif
- Tofler A., Tofler H. (2006), Avuţia în mişcare (Revolutionary Wealth), Editura Antet, 2006, ISBN-10: 973-636-200-0, ISBN-13: 978-973-636-200-2
- Oanta, E., Odagescu, I., Tamas, I. (2007), - "Management Instruments which Use Probabilistic Approaches. Case studies", The 11th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI2007 - The 3rd International Symposium on Management, Engineering and Informatics: MEI2007, Organized by the International Institute of Informatics and Systemics, July 8-11, 2007, Orlando, Florida, USA
- Oanta, E. (2007), Virtual Reality Original Instrument Employed in Crises Management, Proceedings of the 12th International Congress of the International Maritime Association of the Mediterranean (IMAM2007), Varna, Bulgaria, 2-6 September 2007, Maritime Industry, Ocean Engineering and Costal Resources – Editors: Guedes Soares & Kolev, 2008 Taylor & Francis Group, London, ISBN 978-0-415-45523-7, pag. 1095-1102
- Oanta, E. (2007), Numerical methods and models applied in economy, PhD Thesis, Field of science: Cybernetics and Economic Satistics, Academy of Economical Studies of Bucharest, Under the scientific guidance of Prof. Ec. Mat. Ioan Odagescu
- Oanta, E., Panait, C., Nicolescu, B., Dinu, S., Pescaru, A., Nita, A., Gavrila, G. (2007-2010), Computer Aided Advanced Studies in Applied Elasticity from an Interdisciplinary Perspective, ID1223 Scientific Research Project
- * * (2006), Solid Edge v18 course, organized by ADA Computers, http://www.adacomputers.ro/