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Autor: Anderheggen, E.
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SESSION III

DISCUSSION

October 7, 1982 - Afternoon

Chairman: E. ANDERHEGGEN (Switzerland)

F. STEIGER - I have a question to Mr. Kruisman. I think The Netherlands are not so a great and big market in the building sector and, if all the mentioned 240 companies accept and buy your system, I assume everyone can do nearly everything. And the question is: how long would the most of these companies still exist because they are all so strong in the market with these powerful tools and the number of clients will not increase?

G. KRUISMAN - This question could be answered fairly simple because, as I indicated, the total group amounted to about 2400 companies, and we only took into account ten percent of this number. So, if this ten percent survives, the problem is solved. But, of course, these companies will not act in the same way. I indicated already that we are trying to bind developments together, to stimulate cooperation between technical disciplines. In each discipline several subjects will be covered. With help of the Nemesis system you can build CAD systems and each CAD system will be connected to one product. So there is a lot of work to do in order to cover all products and I think we will be working for many years.

D.P. GREENBERG - Not without risk, but with the deliberate intention of trying to start a controversy, there were two themes which really came across. One with respect to the need for, not only general databases or relational databases, but database management systems to make it effective in the building industry. The other theme promotes the uses of microcomputers. There is surely a paradox in the fact that the microcomputer can support these large database management systems. I would like to provoke the argument between the panelists on this.

S. FENVES - There are several hardware developments which will make this boundary disappear. A number of manufacturers are producing back-end computers which handle database access. At an even smaller scale, a number of companies are coming out with database chips. INTEL has announced one of these as a product intended to be connected to other micros. Thus, as far as hardware is concerned, I don't think there is any problem: there is a continuity of available hardware to do it, and there is going to be more of it in the future.

H. PIRCHER - I have to say that, if microcomputer configuration is very small, there is no place for database management, but there is a need for some functions coming out from the database. So, in a good system for microcomputer configuration, it is necessary that the program includes some function of the database. If I think of our program for prestressed concrete, for example, it is necessary to organize and store a lot of data and I think that we have various construction stages, each giving us seven or eight lowcases; we must add all the stresses for few construction stages that we have, to store them for later drawing and so on. If all this is functioning in one system of program running on a microcomputer, I think we have some part of the database management system into this program. And it is clear that future development in hardware will produce some possibilities to include database: possibility also in microcomputer environment, as a program is necessary to define how we can connect these features, if they will be later available. But, actually, we have to do it on a small configuration, if we supply programs for it; because there is always the question of calculation speed, which is limited also by the peripheral devices of a microcomputer and the very cheap hard disks of five or ten megabytes (already available) are slow.

E. ANDERHEGGEN - So we are really expecting an other computer generation, which is probably coming very soon.

G. KRUISMAN - And there are already several database systems running on 8 bit, 64 Kb memory micros.

H. PIRCHER - But, if we include it in a complete calculation system, we will get unbelievable calculation-times, not calculation, but waiting-times.

E. ANDERHEGGEN - If I may add a comment, I think database makes sense if there are multiple accesses from different applications to the same database. If you have only one program that accesses the database, this is not a database any more, it makes no sense. You can save your data on tape every week or something like that.

H. PIRCHER - But there are already microcomputer systems available, where it is possible to connect a lot of microcomputer systems in one network,that excess the common disk-space.

S. SHIMADA - In our research laboratory, students are very fond of gaming on TV screen using the microcomputers and they are gaming without making the report of their home task. But, during this gaming, we found some problems on the use of computers. And one is reliability for some accident. Yesterday,for instance, we had a very strong thunder storm and some of the thunders caused accidents. The memory is attached sometimes and changes the data during the computation. When the students were gaming on TV screen, the game works were found wrong. I think this is one of the most important problems for the professional calculators.

E. ANDERHEGGEN - I think it is a problem of data security, can anybody comment on that?

H. PIRCHER - Yes, that is the same problem. Then for each other computer (you have the same problem on a big unirecord on a VAX),if you look at reliable micro computers, you can see that there are some for the price of thousand dollars and there are others for the price of ten thousands dollars, all based on the same CPU chip. The main difference between both machines is the quality of the power supply into the machine and there are very very cheap personal computers, which are only cheap and, if you go to a special floor and you put the hand on it, you can switch it off immediately. But there are other machines, with well insulated housing and with a good power supply, so that you have the same quality than a big computer, and also the same possibilities to avoid such events.

S. SHIMADA - Yes, but in our research most of the study is carried out in the field and the field works are very often attached by several thunders, because we are working in the open structure-sites and sometimes the cables are extending to some thousand meters from the local working station; these cables sometimes are attached. So we are now trying to ensure them most reliable transmission for the automated and robotic measurements.

J. BLAAUWENDRAAD - I have two questions. The first question is directed to the people who were speaking on database management systems. A couple of years ago, at a symposium of NASA in Washington, Lockeed and Boeing both had a strong plea, why they did not use the available administrative management database systems. They argued that they had to make specific database systems which were oriented to engineering. The question is: is airplane industry so different from structural engineering that we have to do it in an other way, or have we changed our minds in the last three or four years? The second question is (that is to all panel members, I think): we are speaking of the impact of technology of hardware and software to our field, the economical recession in western community might be a stronger impact in this moment. What do you feel about this impact on what we are doing?

K. VAN DER WERFF - As a matter of fact I don't think that there is very much difference in aerospace industry. Months ago I heard of the Dutch National Lucht - en Ruimtevaart Laboratorium, they had installed a big database system which covers all their activities, it was from CDC and I think it was a quite normal database system.

S.J. FENVES - The Lockeed system is not generally available. The database management system that cames out of ICAM is the one that I mentioned. It is called RIMS, it is distributed by Boeing, and now private companies are also marketing it. The one substantial change they have made was to add matrices and vectors as additional attribute types.

J. BLAAUWENDRAAD - As for the answer of Dr. Van der Werff,I agree that the Dutch Aerospace Institute did use an available database management system, but when I asked for the reason, it was just financial. They had their problems using it, but they could not effort to do an other new effort themselves. Therefore I asked: wasn't it possible for Boeing then to use one of the available administrative systems?

S.J. FENVES - It is a very small package; they admit that it was initially developed for their own internal education. I listed a minimum of four things that I feel administrative databases don't contain and of those four RIMS only implemented one.

K. VAN DER WERFF - It is also not very clear to me. On the IFIP Conference on CAD databases in 1981 it was stated that the requirements we have for engineering databases are exactly the same as they have for administrative databases. The only difference may be that some people say that engineering database should have a flexible structure, so it should dynamically be changeable, but I am not quite sure about this requirement. Dynamically means that you can dynamically change the logic of your data.

E. ANDERHEGGEN - Does the application program play the role of the classical database administration someway?

K. VAN DER WERFF - Yes it is possible in relational database. You can just relate the most strange things with each other. That's dynamical but that is also dangerous because you might get up to inconsistent database.

E. ANDERHEGGEN - And, if there are multiusers to the same database, it might run into problems with other users as much as I understand (I am not a database specialist). So we have other questions? Oh, I forgot the political question. Who wants to say something about that?

P. LENGYEL - I think this has a lot to do with yesterday's very interesting discussion concerning who should take the lion's share in CAD development: the universities or the software houses? I feel that here the computer manufacturers have to be very active. I work at a computer factory in Hungary producing basically mini computers and we think that we have to help the users in this field. I try to sum up shortly what I see here as a way out concerning economic difficulties of the bases of program development.

E. ANDERHEGGEN - If I understood the question correctly, it was about the european recession and now you say you feel responsible for this. Well, I don't think you are responsible. I just want to make sure that you understand each other correctly. The problem was that we all feel in many european countries a recession and this might have some consequence. May be people have more time to develop software, in this sense it could be an advantage, but I don't want to interrupt you, just to get the contact between you two.

P. LENGYEL - What we do - and I think this way is very advantageous to be followed by other manufacturers too - is developing program packages by ourselves or make them made by software houses in the following way. We get into contact with real or potential users and then, according to their wishes, we shape our program library being developed partially by software houses, universities departments or by ourselves. The hardware for all this is developed by us, the manufacturer. We feel that, if all the three parties concerned are working together, it contains scientific and economic advantages as well. Namely one gets good brains from software houses and universities departments and a direct contact between them and the industry. Thus there is also more money provided for the development. So I can say this is a solution which works well in this field.

E. ANDERHEGGEN - If I can make a comment, I think one of the few industries we have, which we ignored in this session, is probably the hardware industry.

H. PIRCHER - I can make some comment on this question. I have the experience that, especially in times when economics is more down, it is more important for industry to make rationalization and I think software development is a deem which should help rationalization. Infact, especially in the years with bad economics, we got some orders only due to the fact that rationalization was necessary and, especially in software development, the time now is not so bad as for other parts of economics.

H. WERNER - Mr. Lengyel indicated that we will have a lack of practical application in the '80s. Bearing this in mind, I would like to ask Dr. Pircher, or other gentlemen who are involved in finite element program development or application: Let us suppose you implement a finite element program on the micro, and that micro with this program is bought by a small consulting firm. How can you ensure that this powerful tool is used in a correct, in a proper way?

H. PIRCHER - That is a nice question, but first statement is that I know very small engineering offices having a lot of very specialized knowledge about something, may be finite elements. For example, we have three or four customers using finite element programs on very small machines. There is only one man, but one man who knows what he does. But it is clear that very often there is people buying a program, may be a finite element program, with the illusion that this program replaces the knowledges and I have to repeat my statement that the computer should support an engineer, but it cannot replace him. And it is really very dangerous to give sophisticated software to people unable to understand it, and sometimes, if we recognize that the situation will be bad, we refuse delivery of programs. We did it, because in our prices we include the maintenance for one year and, if we give a program to a customer which calls us by telephone every time he switches on the machine, this is the end of business. And that is the problem: how to give the needed knowledge not only to students, but also to engineers being in practical work for ten years.

J.P. RAMMANT - May I propose three solutions to the question? First you should give the customer as much graphics as possible. Help him to use graphics, that's what we try to do. Second solution: keep the price of the programs high, what do you think? Third solution: we give regularly seminars on the application of finite elements and therefore we use people from the university coming to practice.

P.J. PAHL - With your permission, Mr. Chairman, I would like to return to the question of government support. And I would like to specifically ask Mr. Kruisman the reason of the statement he made this morning, that he considers some support from the government as an essential precondition for realizing his project. If we look at the experiences we had in the Federal Republic of Germany, we find that about 15 milion marks a year for support in the CAD area have been completely stopped within the past two years because of economic developments. This implies that, if we rely only on government, we become extremely dependent on government. Could you comment on this?

G. KRUISMAN - Fear is a bad leader, but a good incentive. And there is fear among companies for their continuity, because work is going down. There also is fear within government that does not have a proper policy towards new technology. In Germany the government has stopped giving money. The same applies to England. Both governments have already given in the past. In the Netherlands this is not the case. So Dutch government has started now and - maybe in some years, after this project is finished - they will stop too. I think that the economic recession generates fear and that's why good ideas are supported now by Dutch government.

B.A. SZABO - The problem identified by Prof. Werner is a very important one.

Abuse of the technology is certainly widespread. It has been said that "it is almost impossible to make anything foolproof, because fools are so ingenious". Nevertheless, there is work going on at the University of Maryland and at Washington University in St. Louis, for example, to make finite element analysis as foolproof as possible. As a result of this work, adaptive finite element computer codes will become available in a few years. Such computer codes will not only yield data which are of interest to users, but will also provide reliable and close error estimates in various norms. In his presentation Dr. Peano described certain steps in this direction. As we have seen, a p-version code is already in existence, which makes it possible to change the number of degrees of freedom by an order of magnitude with minimal user intervention and permits assessment of the effect of that change on the computer data.

H. WERNER - I have a specific question to Dr. Peano. Dr. Peano, you showed us very impressive high order elements. I have two questions; the first one is: what was the main reason for the development of this element and what about computer time for running high order elements in relation to many simple elements? The second question concerns the accuracy: is it checked by the user just looking at the results or have you automatic accuracy checks implemented? If yes, which?

A. PEANO - The first motivation for development of high order adaptive Finite Element techniques was data reduction. By reducing the number of elements, you reduce the amount of data in input and in output and save manpower in data preparation and in evaluation of results. The computer time is also reduced, because you end up using less degrees of freedom. In this regard, the first problem I showed is very illuminating. That problem was solved by using NASTRAN and more than five thousand degrees of freedom. However the result obtained using quadratic elements, with only six hundred degrees of freedom, was better than the one obtained with five thousand degrees of freedom and linear elements. The reason why the user selected many linear elements is that the simpler solution with six hundred degrees of freedom, is useless unless he has a way to know whether the results are reliable or not. This is exactly the capability provided by my approach: by going to the next higher approximation, which required about fourteen hundred degrees of freedom, I am able to validate the results just by simple comparison. And the cost of the two analyses is lower than the cost of one analysis with five thousand degrees of freedom. So I think that the first area of saving is due to the fact that, when there is no way of checking the accuracy, the user is forced to use as many elements as his budget permits. The second point is that there is now the mathematical proof, as well as the practical evidence that, increasing the polynomial order over the same mesh, is more efficient than subdividing the mesh. If you increase the order of interpolation, the convergence rate is twice as much, so you need much less degrees of freedom to reach the same accuracy. Moreover larger element matrices may be computationally advantageous provided you exploit it, for istance, by an array processor or by vector computers. I didn't show here how to automate adaptivity for reasons of time and because it has already been published by "Computers and Structures". Basically a sensitivity analysis is performed by computing locally at each point of the mesh the gain in strain energy expected, if more degrees of freedom are provided in that area. This error indicator is used to locate new degrees of freedom.

G. SCHMIDT-GONNER - I have a question to Mr. Peano. I am involved in the analysis of concrete structures - even with three dimensional finite element models - and I found that, in nonlinear analysis, more elements with simple formulations gave the best results. If there are cracks and other discontinuities in the element, it is not very useful to have high order elements with a high integration order. I am surprised that you use this large high order elements. Are you not looking for nonlinear problems or not dealing with structures with discontinuities?

E. ANDERHEGGEN - Can I also make a comment? I also believe that, when making a nonlinear analysis, you should try to stick to very simple models, so the question comes from both of us. Infact, if you make a non linear analysis, you are more interested in the overall behaviour of the structure, not in stresses which you will never get anyway.

A. PEANO - The point is that 90% or more of finite element applications are still based on linear elastic stress analysis. Non linear analyses are limited in number and are attempted by the most sophisticated users only. In many situations, nonlinear analyses are used to validate design criteria based on linear analysis. For simplicity of application, real design always tends to be based on linear elastic analysis, even when not strictly applicable.
Moreover I expect no difficulties in developing elastic plastic analysis capabilities with high order elements. Of course it is more difficult to model cracking. Still it is possible to try and either subdivide the element or add discontinuous functions. Various levels of sophistication are avaiable but in any case the cost of software development is certainly larger for higher order elements in problems with material nonlinearity.

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