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Author(s)	Fukuda, S.; Murakawa, H.
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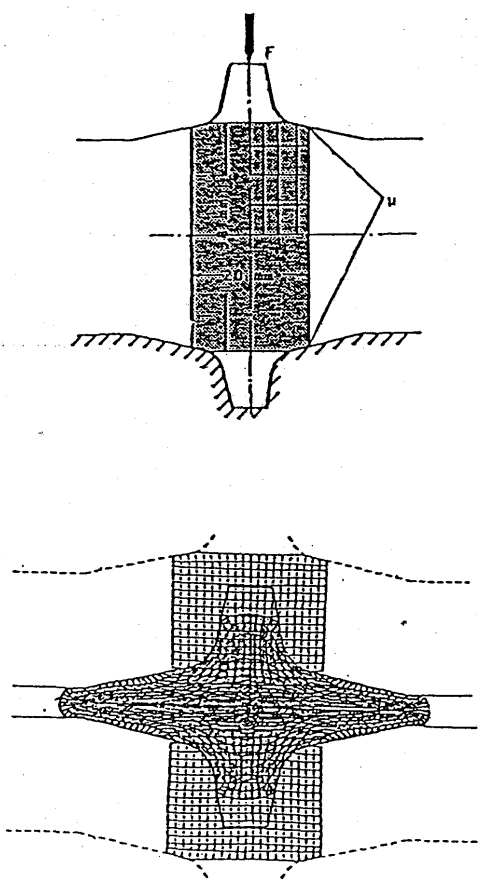


Figure 5 Dye Forging Analysis

typical approach of finite element method is being changed from implicit to explicit, from Lagrangian to ALE because of the following two reasons; 1) physical natures of the methods allow more complicated and more realistic problems to be solved, 2) the methods are more suitable to multitasking as well as vector processing to reduce computational time. Future supercomputers will be smaller but more memory, more number of CPUs and more single CPU vector and scalar power will be equipped along efficient and stable cooling technology.

#### References

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#### “Future Direction of Welding Structure Production”

Prof. J.L. Pan

#### Comment (S. Fukuda) :

As the products are getting more and more diversified and new welding technologies are emerging up, it becomes often necessary to introduce a new way of thinking.

In the former times, manufacturing was made in accordance with the requirements of design. But today we have new welding technologies such as laser or robotics. In applying these new techniques, it would be much easier if we change our design of machines and structures to suit to these new techniques rather than to apply new techniques to the conventional designs. Thus, it seems to me that we should not consider manufacturing alone but we should consider manufacturing and design interactively at the same time. I should be very happy if I could have your opinion on this point.

#### Answer (Prof. J.L. Pan)

- 1) Generally speaking, design should be reasonable so that manufacturing is possible. The manufacturing technique should be good enough to meet the requirements of design. Sometimes when a new manufacturing technique is found, it may tremendously change the relationship between design and manufacturing. For example, if E or laser is to be used for welding of thick wall pressure vessels, it will change the design and ease the manufacturing.
- 2) Concretely if talk about arc welding robot application, would like to say that the main direction is to improve the manufacturing technology. Because the design could not change the picture of uncertainty of manufacturing conditions. For example, inaccurate groove preparation and assembly of weldment made on site in open air. That is the reason why I emphasize the intelligent control of welding process and expert system for welding engineering.

#### Concluding Remarks

Prof. S. Fukuda and Prof. H. Murakawa

Up to now, computers have been utilized to process numbers. But symbolic processing is becoming easier and easier with the rapid improvement of computer environment. What should be emphasized is that numerical processing is of course very important but we should also pay more attention to the utilization of symbolic processing. Or such example is the image processing Dr. Thorpe mentioned.

ioned. Another is expert systems Prof. Pang mentioned. There are more applications, however, such as geometrical feature extraction which regrettably have not been considered so far. The combinatorics aspect of welding has recently been discussed with much attention by the merging of expert systems but the topological aspects are still not too much discussed. We should, therefore, utilize computer's ability to full extent and explore the new frontiers.

*(Prof. S. Fukuda)*

In contrast to the symbolic processing, which is in its research phase, numerical processing has become a relatively matured technology. In other words, computer

simulation utilizing supercomputer is not just the research subject any more. As discussed by Dr. Shimizu and Mr. Kato, supercomputers are already integrated into the research and design procedures in materials processing technology.

Another important aspect of the recent progress of supercomputer is suggested by Mr. Maruyama. "An unthinkable problem today will be thinkable tomorrow due to supercomputers." Research or science itself is the human activity to bring down problems from the unthinkable stage to thinkable stage. Thus, supercomputer has a great potential to play an critical role in the research and development of innovative materials processing.

*(Prof. H. Murakawa)*