RAP SESSION C

CAN MODELING AND SIMULATION REALLY HELP POWER SYSTEM DESIGNERS?

Moderator: L. L. Ogborn, Purdue University
Organizer: G. W. Wester, Jet Propulsion Laboratory

Panelists: J. G. Ferrante, European Space Research Laboratory
             B. G. Herron, Hughes Research
             R. D. Middlebrook, Calif. Inst. of Technology
             H. A. Owen, Duke University
             Y. Yu, TRW

PANELISTS' REMARKS

The panelists discussed a wide variety of approaches to the modeling and simulation of power processing equipment and shared their experiences in the application of these techniques. The program began with a discussion by Mr. Herron of his approach to the simulation of the load presented to an ion thruster where it is necessary to consider all possible dynamic load conditions and to study the resulting power supply responses. His actual simulation is accomplished with hardware.

The academic viewpoint was represented by Professor Middlebrook and Professor Owen. Professor Middlebrook discussed the problem of bridging the gap between the analyst who writes equations and the designer who is responsible for the hardware. His solution to this problem is the development of an approximate model which is easily understood. Both time domain and frequency domain approaches can be used, but he indicated he finds the low-frequency, linearized model easy to use and helpful in making comparisons between approaches as long as the limitations of the model are clearly understood. Professor Owen concurred with this approach and emphasized that it is important that the simulation be easy to use. He also indicated that the person doing the simulation should be nearly as familiar with the details of the system as the designer. The successful use of a small digital computer with an interactive simulation program and a graphic output display was briefly described as an example.

Mr. Yu suggested that the choice between the time domain and the frequency domain may be mainly a function of the experience of the designer. He indicated a preference for the time domain approach since he feels it is general, cost effective, and that it might be advantageous in handling the oscillations of some of the variables. Design optimization and performance prediction were described as areas where modeling and analysis can be beneficial in power electronics.

Mr. Ferrante expressed a preference for analytic approaches at the unit level but feels simulation shows great promise for handling the problems associated with the interconnection of units. He described the present development of these techniques now occurring in Europe and indicated hybrid computation has some cost advantages, but he said that digital techniques are used for checking purposes.

GENERAL DISCUSSION

The panelists' remarks initiated a lively discussion with the audience and the discussion covered many topics. A recent NASA sponsored program on analysis and modeling of power processing systems was discussed and comments and suggestions in formulating the program efforts and tasks were solicited. The questions raised were: how do you stimulate interest and effort in this area at the national level and is it possible to have a basic unified approach to the problem of modeling and simulation? Comments included opinions that it is not possible to standardize analysis techniques or that it is too soon to choose a standardized method and that we need to go through a period where many methods are tried before it will be possible to condense these methods to a few essential, common techniques. The suggestion was made that some form of "normalization" procedure might prove helpful. Interest in better models for thyristors and transistors was also expressed.

SUMMARY

The rap session provided an informal forum for dissemination of information on the state of the art in modeling and simulation of power processing systems. Merits of time domain and frequency domain approaches were debated and the use of these techniques for the prediction of performance and the optimization of a design were discussed. Although it appears that the present state of the art is somethat primative, interest is high and continued progress and improvement should be forthcoming.