

Chapter 2. Cognitive Information Processing

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2.1 Advanced Television Research Program

Sponsor

Center for Advanced Television Studies

Project Staff

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ATRP is funded by the members of the Center for Advanced Television Studies, a group of companies broadly representative of the TV broadcasting industry: ABC, Ampex, General Instruments, Home Box Office, Kodak, NBC, PBS, Tektronix, and Zenith. Additional funding is provided by HBO for development of systems specifically for cable. The function of the program is to find ways to design improved TV systems, to encourage students to enter the TV industry, and to provide a forum for sponsors to discuss matters of common interest without violating antitrust laws. The work is carried out in the Media Laboratory and RLE.

In the past year, further work has been done on high-definition television systems to provide 1) improved image and sound quality without using more channel capacity and 2) greatly improved resistance to impairments due to transmission in typical analog channels. The MIT-RC system is compatible with existing receivers, providing improved quality on special receivers. The MIT-CC system is noncompatible, but achieves true high-definition within one standard channel. The two systems are members of one "family," and the same special receiver can be used for both. An adaptive FM system is being devel-

oped to permit improved efficiency in transmission through satellite channels.

We have also carried out audience research from a facility located in a suburban shopping mall to determine how much the public is interested in and willing to pay for HDTV. We have found substantial interest, but a reluctance to pay a large premium just for improved technical image quality. Another result of the audience study is strong evidence that channel impairments, and not transmitted resolution, set the limit on picture quality in typical homes.

Our group is participating in the FCC Inquiry on this subject. An important factor that has emerged from the inquiry is that improved interference performance is mandatory for new systems. This result is due to the fact that today's "taboo" channels — those that cannot be used because of interference effects — *must* be used to broadcast HDTV signals.

Because of the FCC work showing the importance of interference performance and because of our audience studies showing the effect of channel impairments, we have concentrated our efforts on these matters. By using a combination of subband coding, adaptive modulation, and scrambling, it is possible to reject noise, interference, ghosts due to multipath effects, and frequency distortion to an unprecedented degree. Good pictures are obtained at a carrier-to-noise ratio of 16 dB and with ghosts and interference of -8 dB. When two signals in this format interfere with each other, good reception is attained at 12 dB protection ratio, as compared with at least 28 dB for the current NTSC system.

Publications

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2.2 Computer-Aided Fabrication System Structure

Sponsor

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2.2.1 Introduction

The Computer-Aided Fabrication (CAF) system structure carried out within RLE is a part of a larger project within Microsystems Technologies Laboratories. The overall goal of the CAF project is to integrate computers into the control, data collection, modeling, and scheduling of the integrated circuit fabrication process. The CAF project has several goals. One goal is to provide effective management of information associated with the fabrication of integrated circuits to improve flexibility, portability, and quality and to minimize turnaround time, development cost,

confusion, error, and manufacturing cost. Another goal is to provide a way to operate a fabrication facility without using paper in the clean room. A third goal is to provide a framework for the creation of information that has usually not been available in a concise or precise way.

2.2.2 Progress During 1988

During this past year, we made two major releases of our CAFE software. We installed INGRES 5.1, an updated schema, operate-machine, and a series of applications programs related to status and log reports.

A comprehensive set of data base tools, DBTOOLS, was completed by Mike Ruf. These include:

dbinspect a "data base walker" program which enables application programmers (and others) to find their way around the existing data base. It displays an existing entity and allows the user to explore related entities. For example, one can display a facility and see that it has a list of machines. From there one can display a particular machine and see its attributes, etc.

dbcreate to create entities without writing a special application program.

dbquery to implement data base queries.

dbmutate to enable changes to be made to existing entities.

dbchoose to select entities from the data-base.

A number of application programs pertaining to status and log reports were completed. These included: 1) change status - to enter data relating to status changes, 2) describe machine - to display current status, 3) new machine - to enter a new machine into the database, 4) format equipment - to report the status of all equipment in a facility, 5) up - a generalized status and log report generator, and 6) dbt - to transfer file based data to the

database. The up program can produce graphs of uptime for a selected machine for a selected period of time or, alternatively, a summary of the relevant log entries relating to machine status changes. The graphs can be output on a terminal or laser printer via giraphe3 which was written by Duane Boning and Bob Harris.

A new program, operate machine, was written and is used to make log entries when a machine is operated. It also provides a base for the creation of machine specific data entry and will be expanded substantially in the near future. The operate machine program has been expanded to create work in progress (wip) entities when the program is exited without the finish time being specified. Operate machine now records the lot and wafer sets that are being processed.

We have interfaced the Gyrex mask maker directly to the computer as opposed to requiring users to write data to magnetic tape and transport these tapes to the Gyrex.

We made substantial progress in the development of programs relating to our data model and schema. Our Gestalt system architecture provides a uniform query interface to data residing in multiple autonomous, heterogeneous databases. The Gestalt data base interface routines were expanded to include Lisp interface routines in addition to C interface routines.

We have continued to progress on the development of a process flow language (PFL). The creation of a PFL and associated interpreters is the key to our approach for generating actual fabrication instructions and for collecting the data resulting from actual fabrication steps. The interpreters provide the actual meaning of the process flows expressed in the flow language.

Our previous PFL development was based on only the machine setting view in order to get something working as soon as possible. We now have a version of our PFL which supports the two stage process step model. This model relates the goal of a change in wafer state first to the physical treatment parameters and finally to the actual machine settings

used to process the wafers. We have recoded the CMOS baseline process in this new version and, in addition, have encoded a furnace monitor process which process is routinely used every week.

We have completed an expert PFL editor. This editor uses fabform as the user interface. Ideally one starts with an existing process flow, encoded in a lisp like syntax, which is somewhat similar to the desired process flow. The editor then displays this existing process flow with a forms based presentation and allows the user to modify the flow. The editor then produces the new flow encoded in our lisp like PFL without the user even being aware of the lisp nature of the PFL. The editor supports the three views required by the two stage generic process model and, in addition, allows any number of hierarchical levels of process flow definition.

Our standard user interface, fabform, has been improved and extended so that it can now be called as a procedure from either C or Lisp.

We have made substantial progress on the development of the Profile Interchange Format. We now have versions of the following programs:

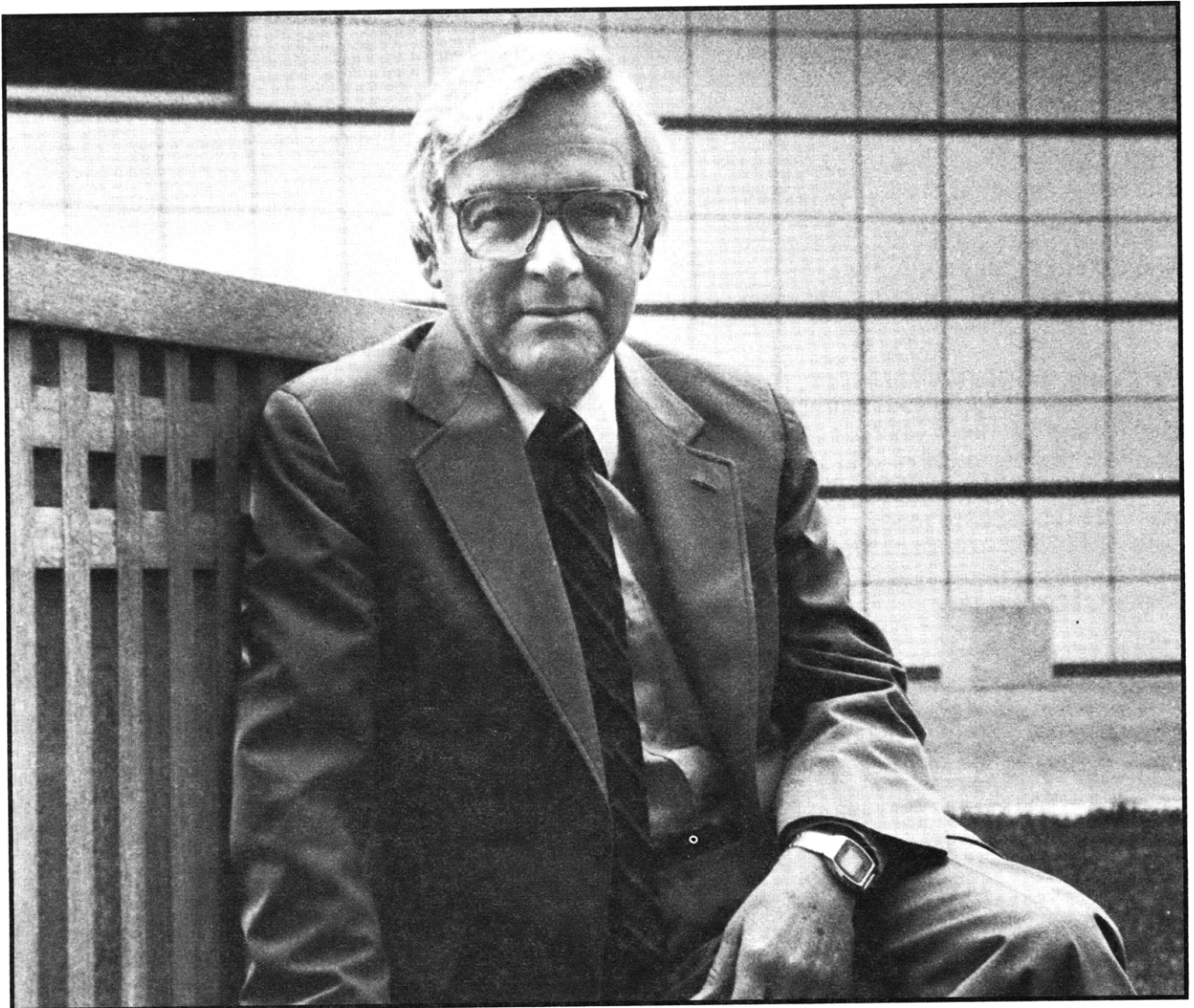
pif2db	Minimal PIF parser (ASCII PIF to PIFDB)
pifdump	PIFDB to ASCII PIF dump
sup2pif	Suprem-III to PIFDB converter
pif2sup	PIFDB to Suprem-III save file converter
pifclean	Delete portions of the PIF database
pifplot	PIF plotting programs

We have made substantial progress on the development of a simulation interpreter. A prototype version of the Suprem-III Simulation Interpreter has been completed. The interpreter generates Suprem-III fragments for multiple one-dimensional cross sections, and provides analysis (plotting, sheet resistance, and threshold voltage) capabilities.

MIT Theses

Jayavant, R., *An Intelligent Process Flow Language Editor*. S.M. thesis, Dept. of Electr. Eng. and Comp. Sci., MIT, 1988.

Zarghamee, N.S., *Schema Viewer: A Graphical Representation To Portray the Database Schema of the MIT CAFE System*. S.B. thesis, Dept. of Electr. Eng. and Comp. Sci., MIT, 1988.



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