970318

John Strawn
15 Willow
Larkspur, CA 94939

John,

Here are photocopies of my Computer Music Conference materials 1974–1977 inclusive. I've put the 2-page S.C. brochure in with 1974 because that's where it was stored in my files — I take that to imply that the brochure dates from then. I know I gave out similar (if not identical) brochures at the 1974 Conference.

Hope this helps —

— RS.

SYSTEMS CONCEPTS 524 SECOND STREET SAN FRANCISCO, CALIFORNIA 94107

SYSTEMS CONCEPTS

DIGITAL SIGNAL SYNTHESIZER

The Systems Concepts Digital Synthesizer is a computer-driven real-time device which creates signals such as represent the sounds of music and speech. It eliminates the former problems of analog synthesizers, such as drift, poor tracking between units, inaccuracy, and inflexibility. It adds the benefits of control from a general-purpose computer, with which sound can be composed, edited, and remembered or recalled in real time or at any slower rate, and it matches the computer in rapid flexibility.

Basic elements of the Digital Synthesizer are generators and modifiers. Generators are controlled sources of signals, and modifiers are controlled signal processors.

Each generator can provide any of the following waveforms: sine, sum of cosines (equal amplitude harmonics), square, sawtooth, or impulse train; performs frequency modulation if desired; and automatically can apply any of the following envelopes: linear rising or falling, exponential growth or decay, or asymptotic rise or fall.

Each modifier can do any one of the following: simulate a pole or pole pair (resonator), simulate a zero or pair of zeros, scale an input, mix two inputs, perform amplitude modulation or ring modulation (four-quadrant multiplication), or generate uniform noise. Basic nonlinear operations are also provided. Arbitrarily complex filtering (low pass, high pass, band pass, band stop) can be accomplished by cascading pole pairs and zeros.

TELEPHONE: 415-433-5400 TWX: 910—372—6062

System architecture permits sums to be formed of the outputs of any number of generators or modifiers. The output of any generator or modifier, or the sum of several such outputs, can then be used as the data input or modulation input to any modifier, or as the frequency modulation input to any generator.

An optional Delay Memory attachment permits any modifier to act as a delay unit or as an all-pass reverberator.

The number of generators and modifiers available at any instant depends on the sample rate at which the synthesizer is operated.

Sample Rate	Generators Available	Modifiers Available
50 KHz	96	48
30 KHz	160	80
20 KHz	240	120
18.75 KHz or less	256	128

Output can be sent either to four high-resolution digital-to-analog converters, or back to the controlling computer for further processing or storage. Complete test and diagnostic features are built in. Interfacing can be provided for any positive-logic TTL or DTL computer.

A Portable Digital Sound Synthesis System

H. G. Alles

Bell Laboratories
Murray Hill, New Jersey 07974

A complete real time digital sound synthesis system has been constructed. In one compact unit (42" w x 25" h x 18" d, weighing ∿300 lb) shown in Figure 1, the following equipment has been included:

A. A Digital Equipment Corp. LSI-11 based general purpose computing system with

1. Two floppy discs with DMA controllers
2. A 64k word mapable memory for Table and I/O buffering
3. An ASCII and graphics video terminal with full ASCII keyboard

B. A performer interface that samples and independently filters the position of 256 input devices with ∿7 bit resolution (∿100-200 different positions) at a 250 hz sampling rate. The input devices include

1. Two 61 key organ type manuals (the position of each key is measured with 7 bit resolution 250 times/sec)
2. 72 slide levers
3. Four 3-axis joy sticks
4. A variety of other things

C. A 16 bit digital synthesizer operating at 30k samples/sec with

1. 32 FM sinewave oscillators (.002 hz frequency resolution and 14 bit accuracy)
2. 32 FM oscillators that directly generate the first N ($1 \leq N \leq 127$) harmonics of the specified frequency
3. 32 completely programmable second order digital filters (two pole and two zero) that may be signal controlled

4. 32 AM (4 quadrant) multipliers

5. 256 envelope generators (linear or logarithmic)

6. A 2 second (64k word) digital reverberation and/or signal driven lookup table with 64 programmable taps

7. An array of 192 accumulating registers for interconnecting all the devices in any arbitrary way

8. Four channels of 16 bit D/A output

9. Two channels of 14 bit A/D input

D. An array of 255 independent timers (1 ms resolution) with 16 FIFO's for sorting and storing timing events.

All the devices are bus interface to the LSI-11 computer and all the control words appear in LSI-11 address space ($\sim$6k words). Approximately 1400 IC's are used in the entire system.

All of the system components have been designed to complement each other's capabilities. Special purpose hardware was constructed to perform those tasks which are repetitive and time consuming (timekeeping and performer input filtering).

Since there are no handwired connections between the input devices and the synthesizer hardware, and since synthesizer interconnections are accomplished through program loaded control registers, the whole system may be used in a variety of ways. For example:

A. All the control parameters may be specified in real time and at performance time.

B. Several files may be prepared in real time, but before the performance. Then at performance time the files may be played with some subset of the control parameters supplied during performance.

C. Files may be prepared and/or edited in nonreal time, incrementally improving the original performance.

The total real time synthesis capacity depends, of course, on the type of synthesis techniques and configuration used. The LSI-11 and floppy disc multiple file system can support $\sim$1000 parameter changes/sec. These parameters may be used to specify frequencies, envelopes, configuration changes, graphic displays, etc. This data rate should be able to generate $\sim$100 reasonably complex notes per second.

This system is perhaps the first representative of a new generation of musical instruments that combines in one relatively portable unit all the hardware and interfaces necessary to produce in real time and in a performance environment sounds approaching the complexity of a modest orchestra.

A Modular Approach to Building Large Digital Synthesis Systems

H. G. Alles

Bell Laboratories
Murray Hill, New Jersey 07974

A series of four one-card special purpose processors have been designed and built that allow arbitrarily large digital synthesis systems to be constructed in a systematic fashion. The system may be started very small (one module) and grow a module at a time as additional processing becomes necessary or affordable.

Each module is bus interfaced to a Digital Equipment Corp. LSI-11 microcomputer. Commercial interfaces are available to convert the LSI-11 bus to the PDP-11 Unibus so that any of these modules may be used with any PDP-11 computer. A module requires 1k word of LSI-11 address space for control parameters. The control words may be manipulated by any LSI-11 instruction. A module is built on a 8" x 10 1/2" wire-wrap card (the same size as the LSI-11 processor) with space for 162 IC's. The modules and the LSI-11 with its peripheral cards mount in a common housing. The system produces 32k samples/second data. Typical data paths are 24 bits wide.

Oscillator Module

This module provides 64 FM oscillators with 128 linear or exponential envelope (ramp) generators. It has a 16k word by 14 bit program loaded memory for storing the wave shape the oscillators will produce. Fifteen general purpose registers and an adder are provided to interconnect the oscillators and combine their outputs. All calculations have 24 bit accuracy.

Filter Module

This module provides a minimum of 32 general purpose second order filters (two poles and two zeros). LSI-11 accessed RAM storage is provided to store 128 different filter programs (96 bits each). Each filter section has a control word that specifies the program that it is to execute. The control word may be supplied by the LSI-11 or it may come from a signal path, making in effect a signal (voltage) controlled filter. The filter can also perform some nonlinear functions such as half and full-wave rectification. A filter section may be made into a sine wave oscillator (a filter with infinite "Q") so that it may act as a synthesizer also. A single 32 kHz process may be sub-multiplexed to provide two 16 kHz sections or four 8 kHz sections, thus greatly increasing the number of filter sections available. An array of general purpose data registers are provided so that multiple filter sections may be interconnected and/or their outputs combined.

Reverberation Module

This module provides a 48k word (16 bit) data memory, 64 independent "tap" processes and an accumulating and switching array for interconnection. Each tap process consists of a decrementing pointer, a base address, and a pointer reset value which allows any arbitrary section of the 48k word memory to function as a digital data delay unit. Following the delay unit, there is a multiplier (16 x 16 bit producing a 24 bit product), an adder, and an array of 256 data registers. Control words allow any of these registers to be used as delay inputs, outputs, etc. Thus, there are 64 independent delay units of arbitrary delay length (total delay can not exceed 48k word).

A tap process can also function as a lookup table translator. In this mode, a section of the delay memory is loaded with some arbitrary function by the LSI-11, and writing into this section by the tap process is inhibited. The decrementing pointer is over written by the output of another tap process so that signal data actually supplies the pointer and thus choses the sample from the preloaded table. An arbitrary wave shape oscillator may be made by using one tap process to generate a periodic ramp function (by accumulation) and using this as a pointer to a section of the delay memory that is loaded with the wave-shape.

Another use would be to introduce precisely controlled distortions (particularly amplitude dependent) to simple sinusoids to produce more complex waveforms.

Switch Module

This module provides eight input and eight output time multiplexed ports (24 bit data plus control signals) and a register array to interconnect any combination of the three modules described above. It may also provide connections to A/D's and D/A's, or any future module. An adder and multiplier are included so that signals may be combined and/or scaled in the switch. The register array contains 255 general purpose registers plus a pseudorandom white noise source. These registers appear in LSI-11 address space so that scale values, additive offsets, and signal data may be directly manipulated by program control.

The switch is a high speed processor with a simple instruction set that executes a 480 word program every 32 µsec sample period. The instruction set includes the following operations:

1) Move the n^{th} input port to the m^{th} register

2) Add the n^{th} input port and the m^{th} register

3) Multiply the n^{th} input port and the m^{th} register

4) Move the adder output ot the m^{th} register

5) Move the multiplier output to the m^{th} register

6) Move the m^{th} register to the n^{th} output port

The program is executed in sequence (no jumps) and the position of an instruction in the sequence determines which I/O port and timeslot is utilized. The band width of any port is simply a function of the number of times the port is specified in the program. A simple path from an input port to an output port requires two instructions. A path involving an add or multiply requires three instructions. Additionally, a second (nonactive) program space is provided, and may be swapped with the active program using a single LSI-11 instruction.

This system provides many attractive features. The three basic processing modules may be used alone. Each of them may be configured as oscillators and they provide adders, multipliers, and an array of registers for interconnecting sections. Their inputs and outputs easily connect to A/D's and D/A's. A system may be started with only one module and a simple LSI-11 operating system. Additional modules plug into the LSI-11 bus and may be used independently. As the system grows, a switch module may be added. For gigantic systems, ports of two or more switch modules may be interconnected. Since each module contains a switch and accumulation array of its own, the interconnection may be done in stages which simplifies the center part of the network.

A single LSI-11 will not be able to control a large system, but a multiple LSI-11 system is quite feasible since the control and data paths are independent. By functionally partitioning the processing tasks, the data flow between LSI-11's can be made quite low. Only one processor need have access to a mass storage file system. An analogy can be made to the way an orchestra is controlled. Each LSI-11 is given (via a simple LSI-11 to LSI-11 interface) only the part of the score that it is responsible for synthesizing with the modules connected to its bus (like the performing musicians). The synthesis algorithms and configurations arrive by the same path. There may be many of these processors. Another processor may control the switch and mixing of various parts (the recording engineer). A final processor may act as conductor, keeping the other processors synchronized, distributing global control parameters, and perhaps interfacing to a human performer. In this way, a real time digital orchestra can be assembled in a systematic and rational way without a prohibitively expensive initial investment. Experience gained with the simplier configuration can direct the path of future development without fears of accumulating useless hardware.

A One Card 64 Channel Digital Synthesizer

H. G. Alles

Bell Laboratories
Murray Hill, New Jersey 07974

Pepino di Giugno

IRCAM
Paris, France

A digital synthesizer providing 64 FM oscillators at 32 kHz sampling rate, 128 envelope (ramp) generators, and 15 accumulating registers for interconnecting the oscillators has been constructed from ~160 integrated circuits on one wire wrap card 8" x 10 1/2". A block diagram of one of the 64 oscillators is shown in Fig 1. The synthesizer is bus interfaced to a Digital Equipment Corp. LSI-11 microcomputer. All control parameters appear in 1k word of LSI-11 address space and may be manipulated by any LSI-11 instruction.

The oscillator phase is calculated by a 24 bit accumulator which provides a frequency resolution of ~.002 Hz. The phase is used as the address to a 16k word x 14 bit wave shape table. The samples in wave shape table are loaded by the LSI-11 so that any wave shape may be used. This size table produces ~84 db signal to noise. Additionally, the 16k word table may be divided into two independent 8k tables, four 4k tables, or one 8k and two 4k tables. A control word for each oscillator is used to specify the size of the table and which table is used by that oscillator. Thus, up to four different wave shapes are available simultaneously. One of the wave table sections may be loaded while other sections are being used.

The 14 bit wave table output is multiplied by a 16 bit (signed) amplitude function, and 24 bits of the resulting product are retained. An array of 15 general purpose registers is provided to interconnect oscillators and combine their signals. A 16th register is available as a source of "zeros" and as a sink for unused output data. Each oscillator accesses the array four times. The actual registers used are specified by different four bit fields in the oscillator control word. The oscillator output may be added to the contents of any register and the sum loaded into any other register.

The oscillator frequency and amplitude values are generated by ramp processes that calculate new values at a 4 kHz rate. Each ramp is controlled by 4 words in LSI-11 address space: the start (current) value, the final value, the increment value, and a control word. The increment is added (4000 times per second) to the start until the final is equaled or exceeded, then the final value is continually used until new values are loaded by the LSI-11. Since 24 bit registers are used, ramp times as long as 1/2 hour are available. Any combination of positive and negative values may be specified. There is full protection against all types of overflow.

Any ramp process may be optionally enabled to generate an LSI-11 interrupt when the final value is reached. A First In First Out (FIFO) buffer structure is included to queue the interrupt events so that only one address need be accessed to find which ramps have reached their final value.

The current ramp value may be optionally exponentiated before it is used as the amplitude (or frequency). A read only memory conversion table and shift technique yields .2% accuracy over a 90 db (or 15 octave) dynamic range. Thus, exponential attacks and decays are simply produced and octave frequency scaling is easily done.

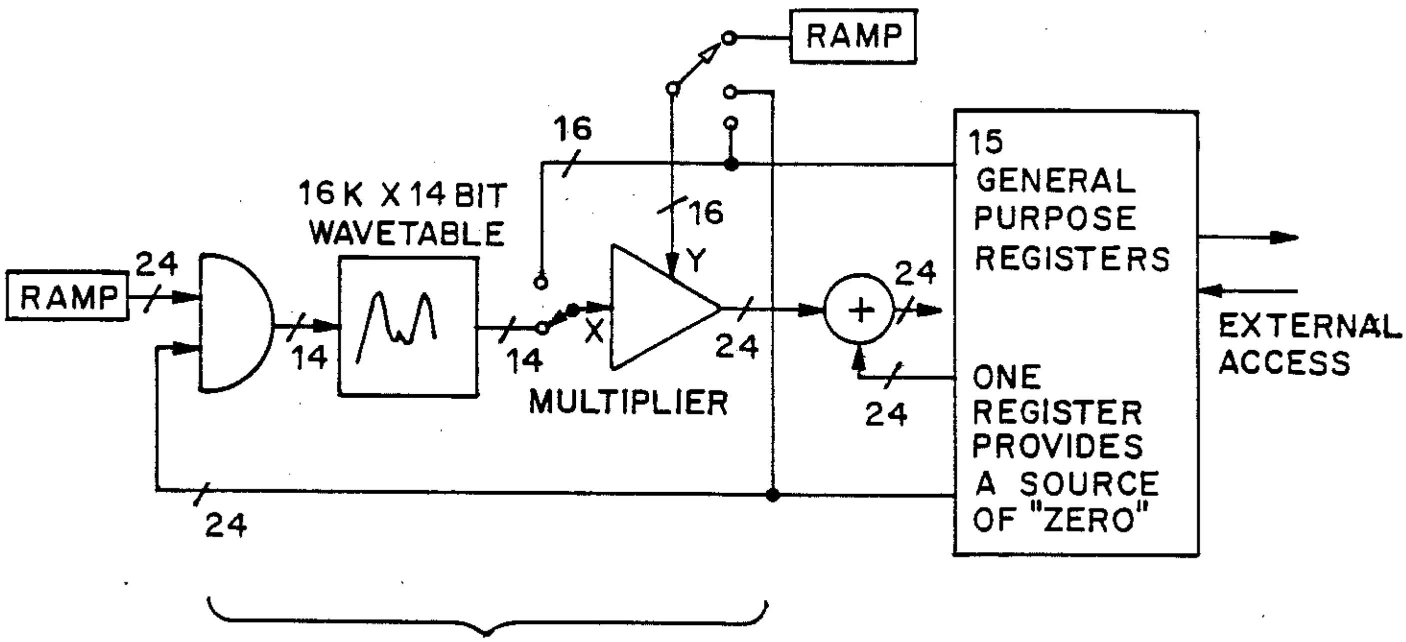
Each oscillator's phase is calculated using two inputs: the ramp process and the data from one of the 16 registers. Thus, the output of one oscillator may be used to linearly modulate the frequency of another oscillator.

As shown in Fig. 1, the multiplier may be used in some optional ways. Data in an array register (rather than the wave table) may be used as the multiplier x input. This allows the amplitude of some complex signal (additive synthesis) to be controlled by a single ramp function (with the sacrifice of one oscillator). The multiplier y input may come from a register also. This allows one oscillator to amplitude modulate another oscillator. Finally the x and y inputs may both come from registers so that the outputs of two oscillators may be multiplied together. The multiplier options and the 15 general purpose registers provide a good deal of flexibility. For example, a second order filter section (two poles and two zeros) may be implemented using five oscillator sections.

The address, data in, and data out signals of the 15 registers are available to external devices for a .5 μsec period every 2 μsec. Data may be read from or written into any of these registers by an external device during this time. If no external address is supplied, the contents of the last register is put out during this time. In the simplest case, a signal from the synthesizer may clock the data to a D/A. However, more complex networks of these synthesizers and other units may be built by using some external circuitry for interconnection.

Control bits are provided so that the phase and ramp processes may be started and stopped synchronously. This allows the synthesizer to be used in a variety of non-real time application. For example, it could be used with a MUSIC V system as a peripheral processor where the synthesizer output data is read into the general purpose computer for further processing.

This versatile synthesizer provides on one compact card substantial real time capabilities. Combined with a floppy disc operating system for the LSI-11, a powerful synthesis system may be had for a relatively small price.



64 WAY MULTIPLEXED

A 256 Channel Performer Input Device

H. G. Alles

Bell Laboratories
Murray Hill, New Jersey 07974

A generalized interface between a performer and an LSI-11 microcomputer for use with a digital music synthesizer has been designed and built. It is capable of encoding the positions of 256 independent devices with up to 8-bit resolution at 250 samples per second (64,000 8-bit samples/sec). In this system, 122 of the devices are the keys of two organ-type manuals, 72 devices are "slide pots", 20 devices are pots on "joysticks", and 4 devices are touch sensitive sliders. The remaining channels are available for future use.

A digital filter process is provided to reduce redundant position information.

The processor-encoder and LSI-11 interface is built from ∿ 80 IC's on a wire wrap board the same size (8" x 10-1/2") as the LSI-11 computer card. An additional small printed circuit card (∿ 6" x 4-1/2") containing 5 IC's is required for each group of eight devices. Groups of eight such cards are connected to the processor via a "daisy chained" 16-wire flat ribbon cable. Thus, only four ribbon cables are required to connect the processor-encoder to the 256 devices.

There are two different types of device cards. One card type encodes the position of any variable resistor. "Slide pots" may be directly soldered onto this card, or the wires from a separate variable resistance device may be soldered to the board. The second card type is used to interface the organ manual keys. A novel capacitive coupled "antenna" is used to sense the key position. Eight antennae, their amplifiers and an 8 to 1 multiplexer are mounted on one printed circuit card. The antennae are spaced to match the key spacing. The cards are simply mounted below a standard keyboard so that the normal switch pins make mechanical contact with the antennae. The mechanism can resolve ∿ 100 different positions of a key.

The keys have been weighted and extra strong return springs are used to produce a more pleasing "feel". Rubber bumpers are mounted below each key so that they quickly increase the effective spring constant after the keys have been depressed ∿ 70% of their allowed travel.

The position versus time information from a key may be processed by the LSI-11 in a variety of ways to derive interesting control parameters. The velocity may be accurately obtained by taking the first difference of successive samples. The static position during the last 30% of travel is a function of the key pressure. More complex types of motion may be detected and used to specify any variety of control parameters.

This interface system is particularly clean in appearance and easy to maintain. Since the device cards are physically close to the devices they are encoding and since the cards are daisy-chained together in groups, very few wires are required for the complete interface. This greatly simplifies construction, debugging and maintenance. Individual device cards are interchangeable and simple to replace. Since the interface to the keys does not use any moving electrical contact or switch, they are relatively trouble free.

This interface provides an extremely broad band data path from the performer into a computer. It should be able to encode all the information a musician can produce in real time, including those subtleties often missed by conventional music keyboards.

PROGRAM

MUSIC COMPUTATION CONFERENCE
December 2 and 3, 1974
MICHIGAN STATE UNIVERSITY

East Lansing, Michigan 48824

Because of the unfortunate weather and the many delayed arrivals, the starting time of the conference has been shifted to 1:30 Monday. Additional reorganization of the sessions may be required.

All conference sessions will be held in Room 33 of the MSU Union.

December 2

MONDAY AFTERNOON:

12:00 Registration desk opens in front of Room 33 in the MSU Union.

1:30 PROGRAMS AND COMPOSITIONAL ALGORITHMS

MUSIC COMPUTATION AT THE CENTER FOR MUSIC EXPERIMENT
Bruce Leibig, University of California, San Diego

RECENT WORK IN COMPUTER-AIDED COMPOSITION AND DIGITAL SOUND SYNTHESIS
Gary Nelson, Oberlin Conservatory

HYBRID SYSTEMS

OBERLIN HYBRID COMPUTER MUSIC PROJECT
Sergio Franco, Oberlin Conservatory

THE ISMUS PROJECT AT IOWA STATE UNIVERSITY
Stefan Silverston, Iowa State University

EXPERIMENTS WITH A HYBRID SYSTEM
J.E. Lay, Michigan State University

LATE AFTERNOON AND EARLY EVENING:

SPECIAL PURPOSE HARDWARE FOR DIGITAL SYNTHESIS

A DIGITAL MUSIC SYNTHESIZER BASED ON DIGITAL FILTERS
Harold Alles, Bell Telephone Laboratories, Murray Hill, N.J.

THE DIGITAL SYNTHESIZER AT THE CENTER FOR MUSIC EXPERIMENT
Robert Gross, University of California, San Diego

THE SYSTEM CONCEPTS DIGITAL SYNTHESIZER
Peter Samson, Systems Concepts, San Francisco, Ca.

A REPORT FROM MIT
Barry Vercoe, Massachusetts Institute of Technology

Discussion led by Andy Moorer, Stanford University

MONDAY EVENING:

8:30 CONCERT OF COMPUTER RELATED MUSIC, MSU UNION BALLROOM

Music Computation Conference — Tuesday Program

All sessions will be held in Room 33 of the MSU Union

December 3

TUESDAY MORNING:

9:00 COMPOSITIONAL ALGORITHMS

MUSIC COMPUTATION AT COLGATE UNIVERSITY
Dexter Morrill, Colgate University

COMPUTER MUSIC FOR THE COMPOSER
Wayne Slawson, University of Pittsburg

10:30 Coffee

10:45 ON COMPOSITIONAL ALGORITHMS
John Melby, University of Illinois

COMPUTER COMPOSITION WITH TRADITIONAL NOTATION OUTPUT
Don Byrd, Indiana University

THE DARTMOUTH MUSIC PROJECT
Paul Tobias, Dartmouth College

12:00 Lunch

TUESDAY AFTERNOON:

1:15 METHODS FOR ANALYSIS AND SYNTHESIS

TONEAN: A PROGRAM FOR TIME VARIANT HARMONIC ANALYSIS
James Beauchamp, University of Illinois

ANALYSIS BASED ADDITIVE SYNTHESIS
Andy Moorer, Stanford University

3:00 Coffee

3:15 PSYCHOACOUSTICS AND COMPOSITION OF TIMBRE

MULTIDIMENSIONAL PERCEPTUAL STRUCTURES FOR THE REPRESENTATION OF TIMBRE
David L. Wessel, Michigan State University

RECENT EXPERIMENTS ON TIMBRE SPACES
John M. Grey, Stanford University

"untitled presentation"
John Chowning, Stanford University

TUESDAY EVENING: Hold open for weather delayed sessions.

This conference was made possible by a grant from the National Endowment for the Arts, and assistance from the Department of Music, Department of Psychology, Computer Institute for Social Science Research, and Computer Laboratory of Michigan State University. Special thanks go to the MSU Union Activities Board.

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MUSIC COMPUTATION CONFERENCE
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10:45 Coffee

11:00 <u>HYBRID SYSTEMS</u>

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Stefan Silverston, Iowa State University

EXPERIMENTS WITH A HYBRID SYSTEM
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12:20 Lunch

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1:30 <u>SPECIAL PURPOSE HARDWARE FOR DIGITAL SYNTHESIS</u>

A DIGITAL MUSIC SYNTHESIZER BASED ON DIGITAL FILTERS
Harold Alles, Bell Telephone Laboratories, Murray Hill, N.J.

2:30 Coffee

2:45 THE SYSTEM CONCEPTS DIGITAL SYNTHESIZER
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James Beauchamp, University of Illinois

THE HETERODYNE FILTER AS A TOOL FOR ANALYSIS OF TRANSIENT WAVEFORMS
Andy Moorer, Stanford University

3:00 Coffee

3:15 PSYCHOACOUSTICS AND COMPOSITION OF TIMBRE

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"untitled presentation" providing the French airlines do not strike
John Chowning, Stanford University

This conference was made possible by a grant from the National Endowment for the Arts, and assistance from the Department of Music, Department of Psychology, Computer Institute for Social Science Research, and Computer Laboratory of Michigan State University.

PROGRAM

MUSIC COMPUTATION CONFERENCE II

(subject to minor changes in time and order of talks within sessions)

Place:	407 Levis Faculty Center (except as noted)
When:	Friday, November 7
9:00 A.M.	Registration in lobby of Levis Center
	SESSION 1 - Software Synthesis Techniques
10:00 A.M.	"Using Circulant Markov Chains to Generate Waveforms for Music" by Mark Zuckerman and Kenneth Steiglitz, Princeton University
10:25 A.M.	"Recursive Digital Filtering in Music Computation" by James Justice, University of Oklahoma
10:45 A.M.	Break
11:00 A.M.	"Vocal Tract Modulation of Instrumental Sounds by Digital Filtering" by Tracy Lind Petersen, University of Utah
11:25 A.M.	"Orthogonal Transforms for Sound Synthesis" by Robin B. Lake and Ralph Cherubini, Case Western Reserve University
11:45 A.M.	Question Period
12:00 P.M.	LUNCH
1:30 P.M.	Invited Speaker Charles Dodge, Columbia University
2:20 P.M.	Discussion
2:30 P.M.	Break
	SESSION 2 - Composition with Computers 1
3:00 P.M.	"Musical Considerations in Computer Music" by Hubert S. Howe, Jr., Queens College
3:25 P.M.	"MP1: A Computer Program for Music Composition" by Sever Tipei, Roosevelt University
3:45 P.M.	Break
4:00 P.M.	"Is a Computer 'Composing Instrument' Possible?" by Sterling Beckwith, York University
4:25 P.M.	"Sixteen Pitch 'Systems' Compared"
5-7 P.M.	Cocktails
9:00 P.M.	Computer Music Concert in the Music Building Auditorium.

Saturday, November 8

SESSION 3 - Information Processing Systems

9:00 A.M.	"A Computer-Synchronized, Multi-Track Recording System" by Larry Austin and Larry Bryant, University of South Florida
9:25 A.M.	"XY Music Input Terminals" by Armando Dal Molin, Music Reprographics
9:50 A.M.	"A Model for Detection and Analysis of Information Processing Modalities in the Nervous System Through an Adaptive, Interactive, Computerized Electronic Music Instrument" by David Rosenboom, York University
10:10 A.M.	Break
10:20 A.M.	"L'emploi de l'ordinateur pour la transcription des tablatures" by Helene Charnasse, Ivry, France
10:45 A.M.	"Soleil--Presentation in Sound and Light" by Gary Levenberg and Bruce Rogers, Indiana University
11:10 A.M.	"Audio Interfacing of the PLATO Computer-Assisted Instructional System for Music Performance Judging" by G. David Peters, University of Illinois
11:30 A.M.	Questions
11:45 A.M.	Lunch
1:00 P.M.	Invited Speaker Barry Vercoe, M.I.T.
1:50 P.M.	Discussion
2:00 P.M.	Break

SESSION 4 - Sound Synthesis Programs

2:10 P.M.	"The Timbre Tuning Digital Synthesis System" by Bruce Leibig, University of California at San Diego
2:35 P.M.	"Sound Synthesis by Rule" by Ercolino Ferretti, University of Utah
3:00 P.M.	"MUSA: Language for Digital Music Synthesis" by Barbara L. Lucido, Columbus, Ohio
3:25 P.M.	"A Simple Musical Language for the Dartmouth Digital Synthesizer" by Jon H. Appleton, Dartmouth College
3:45 P.M.	Questions

DEMONSTRATIONS, Experimental Music Studios in the Music Building

4:30 - 6 P.M. 16 bit D/A converter, Stan Kriz

Synthesized binaural experiment, Ercolino Ferretti

T. I. 980A computer/synthesizer system, James Beauchamp, Ken Pohlman, and Lee Chapman

Plato terminal sound output, G. David Peters

COMPUTER MUSIC CONCERT, in the Music Building Auditorium

8:00 P.M.

Sunday, November 9

SESSION 5 - Hardware Synthesis Techniques

10:00 A.M.	"The CME Digital Synthesizer" by Robert Gross, Bruce Rittenbach, and Bruce Leibig, U.C.S.D.
10:25 A.M.	"The Systems Concepts Digital Synthesizer Project--A Progress Report" by Peter Samson, San Francisco, Calif.
10:50 A.M.	"A Modular Addressing Scheme for a Computer Controlled Digital Synthesizer: by James Beauchamp, Ken Pohlman, and Lee Chapman, Univ. of Ill. Urbana-Champaign
11:10 A.M.	Break
11:20 A.M.	"Specification of a 16-bit A-D and D-A Converters for Audio" by Stan Kriz, Three Rivers Computer Corp.
11:45 A.M.	"Real Time Digital Audio Synthesis" by John Roy, Amherst, Mass.
12:10 P.M.	"Real Time F.M. Digital Audio Synthesis" by Steven E. Saunders, Carnegie-Mellon University
12:30 P.M.	Questions
12:45 P.M.	LUNCH
2:00 P.M.	Invited Speaker Lejaren Hiller, State University of New York at Buffalo
2:50 P.M.	Discussion
3:00 P.M.	Break

SESSION 6 - Composition with Computers 2

3:10 P.M. "What is a Musical Dimension?"
by David Wessel, Michigan State University

3:35 P.M. "System Composing"
by Joel Chadabe, State University of New York at Albany

4:00 P.M. "Rhythmic Applications of Geometric Series"
by Joel Gressel, New York City

4:20 P.M. Questions

4:05p - 9:00p
[illegible] - 1:17a

PROGRAM

MUSIC COMPUTATION CONFERENCE
December 2 and 3, 1974
MICHIGAN STATE UNIVERSITY

East Lansing, Michigan 48824

Because of the unfortunate weather and the many delayed arrivals, the starting time of the conference has been shifted to 1:30 Monday. Additional reorganization of the sessions may be required.

All conference sessions will be held in Room 33 of the MSU Union.

December 2

MONDAY AFTERNOON:

12:00 Registration desk opens in front of Room 33 in the MSU Union.

1:30 PROGRAMS AND COMPOSITIONAL ALGORITHMS

MUSIC COMPUTATION AT THE CENTER FOR MUSIC EXPERIMENT
Bruce Leibig, University of California, San Diego

RECENT WORK IN COMPUTER-AIDED COMPOSITION AND DIGITAL SOUND SYNTHESIS
Gary Nelson, Oberlin Conservatory

HYBRID SYSTEMS

OBERLIN HYBRID COMPUTER MUSIC PROJECT
Sergio Franco, Oberlin Conservatory

THE ISMUS PROJECT AT IOWA STATE UNIVERSITY
Stefan Silverston, Iowa State University

EXPERIMENTS WITH A HYBRID SYSTEM
J.E. Lay, Michigan State University

LATE AFTERNOON AND EARLY EVENING:

SPECIAL PURPOSE HARDWARE FOR DIGITAL SYNTHESIS

A DIGITAL MUSIC SYNTHESIZER BASED ON DIGITAL FILTERS
Harold Alles, Bell Telephone Laboratories, Murray Hill, N.J.

THE DIGITAL SYNTHESIZER AT THE CENTER FOR MUSIC EXPERIMENT
Robert Gross, University of California, San Diego

THE SYSTEM CONCEPTS DIGITAL SYNTHESIZER
Peter Samson, Systems Concepts, San Francisco, Ca.

A REPORT FROM MIT
Barry Vercoe, Massachusetts Institute of Technology

Discussion led by Andy Moorer, Stanford University

MONDAY EVENING:

8:30 CONCERT OF COMPUTER RELATED MUSIC, MSU UNION BALLROOM

All sessions will be held in Room 33 of the MSU Union

December 3

TUESDAY MORNING:

9:00 COMPOSITIONAL ALGORITHMS

MUSIC COMPUTATION AT COLGATE UNIVERSITY
Dexter Morrill, Colgate University

COMPUTER MUSIC FOR THE COMPOSER
Wayne Slawson, University of Pittsburg

10:30 Coffee

10:45 ON COMPOSITIONAL ALGORITHMS
John Melby, University of Illinois

COMPUTER COMPOSITION WITH TRADITIONAL NOTATION OUTPUT
Don Byrd, Indiana University

THE DARTMOUTH MUSIC PROJECT
Paul Tobias, Dartmouth College

12:00 Lunch

TUESDAY AFTERNOON:

1:15 METHODS FOR ANALYSIS AND SYNTHESIS

TONEAN: A PROGRAM FOR TIME VARIANT HARMONIC ANALYSIS
James Beauchamp, University of Illinois

ANALYSIS BASED ADDITIVE SYNTHESIS
Andy Moorer, Stanford University

3:00 Coffee

3:15 PSYCHOACOUSTICS AND COMPOSITION OF TIMBRE

MULTIDIMENSIONAL PERCEPTUAL STRUCTURES FOR THE REPRESENTATION OF TIMBRE
David L. Wessel, Michigan State University

RECENT EXPERIMENTS ON TIMBRE SPACES
John M. Grey, Stanford University

"untitled presentation"
John Chowning, Stanford University

TUESDAY EVENING: Hold open for weather delayed sessions.

This conference was made possible by a grant from the National Endowment for the Arts, and assistance from the Department of Music, Department of Psychology, Computer Institute for Social Science Research, and Computer Laboratory of Michigan State University. Special thanks go to the MSU Union Activities Board.

PROGRAM

MUSIC COMPUTATION CONFERENCE
December 2 and 3, 1974
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10:45 Coffee

11:00 HYBRID SYSTEMS

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EXPERIMENTS WITH A HYBRID SYSTEM
J.E. Lay, Michigan State University

12:20 Lunch

MONDAY AFTERNOON:

1:30 SPECIAL PURPOSE HARDWARE FOR DIGITAL SYNTHESIS

A DIGITAL MUSIC SYNTHESIZER BASED ON DIGITAL FILTERS
Harold Alles, Bell Telephone Laboratories, Murray Hill, N.J.

2:30 Coffee

2:45 THE SYSTEM CONCEPTS DIGITAL SYNTHESIZER
Peter Samson, Systems Concepts, San Francisco, Ca.

A REPORT FROM MIT
Barry Vercoe, Massachusetts Institute of Technology

Discussion led by Andy Moorer, Stanford University

8:15 CONCERT OF COMPUTER RELATED MUSIC, MSU UNION BALLROOM

Music Computation Conference — Tuesday Program

All sessions will be held in Room 33 of the MSU Union

December 3

TUESDAY MORNING:

9:00 <u>COMPOSITIONAL ALGORITHMS</u>

MUSIC COMPUTATION AT COLGATE UNIVERSITY
Dexter Morrill, Colgate University

COMPUTER MUSIC FOR THE COMPOSER
Wayne Slawson, University of Pittsburg

10:30 Coffee

10:45 ON COMPOSITIONAL ALGORITHMS
John Melby, University of Illinois

COMPUTER COMPOSITION WITH TRADITIONAL NOTATION OUTPUT
Don Byrd, Indiana University

12:00 Lunch

TUESDAY AFTERNOON:

1:15 <u>METHODS FOR ANALYSIS AND SYNTHESIS</u>

TONEAN: A PROGRAM FOR TIME VARIANT HARMONIC ANALYSIS
James Beauchamp, University of Illinois

THE HETERODYNE FILTER AS A TOOL FOR ANALYSIS OF TRANSIENT WAVEFORMS
Andy Moorer, Stanford University

3:00 Coffee

3:15 <u>PSYCHOACOUSTICS AND COMPOSITION OF TIMBRE</u>

MULTIDIMENSIONAL PERCEPTUAL STRUCTURES FOR THE REPRESENTATION OF TIMBRE
David L. Wessel, Michigan State University

RECENT EXPERIMENTS ON TIMBRE SPACES
John M. Grey, Stanford University

"untitled presentation" providing the French airlines do not strike
John Chowning, Stanford University

This conference was made possible by a grant from the National Endowment for the Arts, and assistance from the Department of Music, Department of Psychology, Computer Institute for Social Science Research, and Computer Laboratory of Michigan State University.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

School of Music

MUSIC COMPUTATION CONFERENCE II

COMPUTER MUSIC CONCERT I

Music Building Auditorium, Friday, November 7, 1975, 9:00 P.M.

VOICES (1974) . . . . TRACY LIND PETERSEN

GEORGANNA'S FAREWELL (1975) . . . . JON APPLETON

"FORANDRE": SEVEN VARIATIONS FOR DIGITAL COMPUTER (1969) . . . . . . JOHN MELBY

SCHERZO (1975) . . . . HUBERT S. HOWE, JR.

"INFRAUDIBLES" (1967) . . . . HERBERT BRÜN

For Five Instruments and Tape

PROGRAM NOTES, COMPUTER MUSIC CONCERT

Saturday, November 8, 1975

MUTATIONS I, by Jean-Claude Risset:

"MUTATIONS I" was commissioned by the Service de la Recherche of the French Radio (O.R.T.F.). All the sounds of this piece have been synthesized with the help of a digital computer. Provided by the composer with a proper description of the physical structure of the desired sounds, the computer using Max Mathews' Music V programs generates a string of numbers (as many as 40,000 for one second of sound) which describe in detail the time waveform of these sounds. ~~The many numbers are then divided into pulses, which form the wave of the synthetic sounds.~~ The piece is not computer-composed, although some limited developments have been realized automatically by the computer.

In "MUTATIONS I", I took advantage of the possibility, afforded by computer synthesis, to use compositional processes at the level of the sound itself - "MUTATIONS I" focuses on harmonic possibilities. The title refers to the gradual transformation from a discontinuous non-tempered 12 tone scale to continuous frequency changes; it also alludes to the mutation stops of an organ.

At the beginning an arpeggio chord provides an initial harmonic structure, which will later affect melody, harmony and timbre. Through natural harmonic development, analogous to the organ's mutations (although more intricate), the harmonic structure gives rise to a dense network of frequencies, yielding evolving textures in which the melody and the harmony are inseparable. After a brief apparition of rows, the discontinuous scale is eroded by the dense harmonic material and by erratic deviations. The steps of the scale dissolve into the continuum of frequencies: sounds will change pitch in a continuous way while staying on the same note, then they will start an endless upward progression. Glissandi which could go up forever undergo timbre changes. At the end, the upward progression accompanied by pitches and spectra related to the harmonic structures, goes up to a point where the low and high pitched components of the harmonic network are liberated.

PROGRAM ETUDE, by Michael Kowalski:

It is question of strategy. Should one fraternize and risk compromise, or remain aloof and unsullied (how boring!)?

I find the fact that this piece was digitally synthesized to be one of the most trivial, uninteresting circumstances attending its composition.

Common knowledge that a piece of mine was computed or digitally synthesized has repeatedly made my work less accessible to those who suspect me of indulging an unproductive fetish.

If news of this meeting gets out, I'm afraid that our reputations as gadget fetishists will be dreadfully enhanced.

POINTS IN TIME, by Joel Gressel:

"POINTS IN TIME" was realized in the Winham Computer Laboratory at Princeton University in 1973-74. It utilizes Fortran subroutines prior to performance to create groups of attack points which articulate geometric series of durations, patterns that accelerate or decelerate regularly.

Geometric series control rhythmic relationships between successive measures, beats and subbeats. Long time periods are in most cases divided by two contrapuntally opposed geometric series of measures. Each measure in turn is subdivided by series of accelerating or decelerating beats which diverge from one another within the measure and reconverge to start the next. The geometric series -- which approximate the familiar sound of a bouncing ping-pong ball or its retrograde -- are presented as clearly differentiable lines at various points of the piece. Particularly in the early sections, however, the series are disguised by overlapping durations, mixed timbres, subdivided beats and intersecting registers. Equal note values are extremely rare, and the tempi of individual lines are in constant flux.

The pitch successions of these lines are often canonic. Minor thirds, tritones, the collection F F# C B, and the trichord G E D#, its inversions, and transpositions are prominent throughout the piece.

PHOENIX, by Larry Austin:

"PHOENIX" is a computer controlled, electronic music composition for four-channel tape. The work was composed in 1974 with and for the SYCOM digital/analog system, employing a PDP 11/10 computer controlling functions on both Moog and Buchla synthesizers. The work explores the polyphonic movement of sound sources, the pitch successions created by such movement, and the spatial textures such combinations provide.

1977 INTERNATIONAL COMPUTER MUSIC CONFERENCE LIBRARY OF PAPERS
(Available at circulation desk, Central Library-see program for hours)

VOLUME 1

THURSDAY

1. "Understanding the Behavior of Users of Interactive Computer Music Systems" - Otto E. Laske.
2. "Design Considerations for Computer Music Systems" - John P. Walsh.
3. "A One Card 64 Channel Digital Synthesizer" - H. G. Alles & Pepino di Giugno.
4. "A Portable Digital Sound Synthesis System" - H. G. Alles.
5. "The Carnegie-Mellon Computer Music System Digital Hardware" - Alice C. Parker, Richard D. Blum, & Paul E. Dworak.

VOLUME 2

FRIDAY

1. "I.N.V.: A Program for Music Processing and Generation" - Curtis Abbott.
2. "Real-Time Software for A Digital Music Synthesizer" - Douglas L. Bayer.
3. "Computer Program to Control A Digital Real-Time Sound Synthesizer" - James Lawson & Max Mathews.
4. "The Composer As Surgeon: Performing Phase Transplants" - Tracy Lind Petersen.
5. "Nuances In the Synthesis of Live Sounds" - Ercolino Ferretti.
6. "Towards Improved Analysis - Synthesis Using Cepstral and Pole-Zero Techniques" - Richard Cann & Kenneth Steiglitz.
7. "Digital Synthesis of Complex Spectra by Means of Non-Linear Distortion of Sine Waves and Amplitude Modulation" - D. Arfib.
8. "A Fuzzy Hierarchical System Model for Real-Time Visual Interpretation in Musical Experiences" - Gary W. Schwede.

VOLUME 3

SATURDAY

1. "Some Simplifications and Improvements of the Stochastic Music Program" - John Myhill.
2. "Composing Grammars" - Curtis Roads.
3. "A Systems Approach to Composition" - Curtis Roads.
4. "New Developments In Stochastic Computer Music" - Jon C. Siddall & James N. Siddall.
5. "Musicol: Musical Instruction Composition Oriented Language" - Peter Gena.
6. "A Microprocessor Based Live-Performance Instrument" - Michael A. Yantis.
7. "A 256 Channel Performer Input Device" - H. G. Alles.
8. "A Device Able to Get and Play Music" - C. Aperghis Tramoni.

9. "Transducers and Computer Music" - Lawrence H. Sasaki & Kenneth C. Smith.

10. "Envelope Control With An Optical Keyboard" - Paul E. Dworak & Alice C. Parker.

VOLUME 4

SUNDAY & UNCLASSIFIED

1. "A Computer Study of Ruggles Melodic Style" - James Tenney.
2. "Psychoacoustic Aids for the Musicians Exploration of New Material" David L. Wessel & Bennett Smith.
3. "Automatic Music Transcription" - Martin Piszczalski & Bernard Galler.
4. "Computer Synthesis of Pivotal Harmonic 12-Tone Rows" - Charles A. Bodeen.

VOLUME 5

STUDIO REPORTS

1. "The Indiana University Computer Music System" - Donald Byrd & Rosalee Nerheim.
2. "Computer Facilities for Music at IRCAM" - John K. Gardner, Brian Harvey, James R. Lawson, & Jean-Claude Risset.
3. "Three Methods for the Digital Synthesis of Chordal Structures with Non-Harmonic Partials" - James Dashow.
4. "GROUPE Art et Informatique de Vincennes" - Marc Battier & Guisseppi Englert.
5. "Computer Music at CNUCE" - Pietro Grossi.
6. "Some Reflections on the Nature of the Landscape Within Which Computer Music Systems are Designed" - Joel Chadabe.

ALSO:
On Reserve in the Central Library

MUSIC, MEMORY & THOUGHT, Otto E. Laske, 1977, 319 pgs.
University Microfilms International, Ann Arbor, Michigan

a Rubish

1977 INTERNATIONAL COMPUTER MUSIC CONFERENCE

OCTOBER 26-30

UNIVERSITY OF CALIFORNIA, SAN DIEGO

1977 INTERNATIONAL COMPUTER MUSIC CONFERENCE

Center for Music Experiment and Related Research
Department of Music
University of California at San Diego

October 26-30, 1977

Conference Committee: Robert Gross
Jean-Charles Francois
Bruce Rittenbach
Bruce Leibig
Wilbur Ogdon
Pauline Oliveros
Bernard Rands

Previous Conferences:

1974	Music Computation Conference	Michigan State University David Wessel, Chairman
1975	Music Computation Conference II	University of Illinois James Beauchamp John Melby Herbert Brün, Chairmen
1976	First International Conference on Computer Music	Massachusetts Institute of Technology Barry Vercoe, Chairman

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Events will be held at the Center for Music Experiment 408 Warren Campus (CME), Mandeville Center Auditorium and Recital Hall, and Room 2722 in the Undergraduate Science Building (USB). The PCS 500 Music CRT will be on display Saturday from 10:00 a.m. to 4:00 p.m. in Room 125 Mandeville Center.

All papers submitted to the conference will be available at the Reserve Section of the Circulation Desk in the Central University Library at the following times: Wednesday, Thursday, 8 a.m. – 10 p.m.; Friday, 8 a.m. – 6 p.m.; Saturday, 9 a.m. – 5 p.m.; Sunday, 2 – 10 p.m.

1977 INTERNATIONAL COMPUTER MUSIC CONFERENCE

Center for Music Experiment and Related Research
Department of Music
University of California at San Diego

Wednesday, October 26

10:00 - 4:00	Registration (CME)
11:00 - 1:00	CME STUDIO DEMONSTRATION (CME)
1:00 - 4:30	SPECIAL INTEREST GROUPS (CME)
1:00	PDP 11 Users meeting Chairman: John Clough, University of Michigan
2:30	Microprocessors, Hybrid Systems
3:30	Digital Hardware Meeting (Main Room) Music Education Applications (Conference Room)
4:30	DISCUSSION: How can composers and engineers involve each other in the design of computer music systems?
1:00 - 4:00	EXHIBITION SESSION I (Recital Hall) Tapes
8:00-10:00	EXHIBITION SESSION II (Recital Hall) Tapes, Performers with Computer

Thursday, October 27

8:30-11:30	SYNTHESIS HARDWARE (CME) Chairman: Peter Samson, Systems Concepts, San Francisco Design Considerations for Computer Music Systems - John P. Walsh The Carnegie Mellon Computer Music System Digital Hardware - Alice C. Parker, Richard D. Blum, and Paul E. Dworak A One Card 64 Channel Digital Synthesizer - Pepino di Giugno and H. G. Alles A Portable Digital Sound Synthesis System - H. G. Alles A Modular Approach to Building Large Digital Synthesis Systems - H. G. Alles The Systems Concepts Digital Synthesizer: Technical Development and Functional Characteristics - Peter Samson
8:30-10:30	TUTORIAL (Recital Hall) Computer Music Fundamentals - J. A. Moorer, IRCAM, Paris
10:45-11:45	USER PSYCHOLOGY (Recital Hall) Understanding the Behavior of the Users of Interactive Computer Music Systems - Otto Laske
12:00 - 1:00	CONCERT (Auditorium) Welcoming Address - Pauline Oliveros Solo for Bass and Melody Driven Electronics - David Behrman David Behrman, Electronics; Bertram Turetzky, Contrabass

Thursday, October 27 (cont.)

2:30 STUDIO REPORTS I (Auditorium)
Chairman: Wilbur Ogdon, UCSD
James Dashow, Rome, Italy
Joel Chadabe, S.U.N.Y. at Albany
Marc Battier, Giusseppe Englert, Groupe Arte et Informatique de Vincennes
Barry Vercoe, Massachusetts Institute of Technology

4:00 - 7:00 EXHIBITION SESSION III (Recital Hall)
Tapes

7:30 STUDIO REPORTS II (CME)
Chairman: Pauline Oliveros, CME
THE STANFORD UNIVERSITY CENTER FOR COMPUTER RESEARCH IN MUSIC AND ACOUSTICS (CCRMA):
The CCRMA Computational Facility Part I - J. A. Moorer
The CCRMA Computational Facility Part II - Gareth Loy
Editing, Mixing and Processing Digitized Audio Waveforms - Loren Rush
The Effect of Musical Context on the Psychoacoustic Measurement of Timbre Discrimination - John Grey
Multidimensional Scaling of Musical Timbres - John Gordon
An Experiment in Auditory Distance Perception - Christopher Sheeline
A Computer Language for Psychoacoustic Study and Musical Control of Timbre - Mark Kahrs
John Chowning introduces the section on Synthesis
The Simulation of Natural Instrument Tones Using Frequency Modulation with a Complex Modulating Wave - Bill Schottstaedt
Some Compositional Applications of Infrasonic Phase Modulation - Michael McNabb
Waveshaping Synthesis - Marc Le Brun
The F. Richard Moore Digital Synthesizer - Julius Smith

Studio Reports are special sessions intended to provide information about specific facilities. Discussion will be directed towards composer interaction with the systems available. Most studio reports will include performances of representative pieces produced at each facility.

Friday, October 28

8:30 - 9:45 SOFTWARE FOR SOUND SYNTHESIS (Auditorium)
Chairman: Bruce Leibig, CME
INV: A Language for Music Processing and Generation - Curtis Abbott
Real Time Software for a Digital Synthesizer - Douglas L. Bayer
Computer Program to Control a Real-time Sound Synthesizer - James R. Lawson and Max V. Mathews

10:00-10:30 DISCUSSION (Recital Hall)
Charles Lipp and Jean-Charles François discuss "Mutatis Mutandis" and "Plot" (performance on Saturday evening) with composer Herbert Brün

Friday, October 28 (cont.)

10:15-12:30 SYNTHESIS TECHNIQUES (Auditorium)
Chairman: J. A. Moorer, IRCAM
Composer as Surgeon: Performing Phase Transplants - Tracy Peterson
Nuance in the Synthesis of Live Sounds - Ercolino Ferrett
A Technique for Time Variant Filter Design - James Justic
Towards Improved Analysis/Synthesis Using Cepstral and P Zero Techniques - Richard Cann and Kenneth Stieglitz
Digital Synthesis of Complex Spectra by Means of Non-lin Distortion of Sine Waves and Amplitude Modulation - Dan Arfib

12:00 - 3:00 EXHIBITION SESSION IV (Recital Hall)
Audio and Video Tapes
1:00 PAPER: A Fuzzy Hierarchical System Model for Real Time V Interpretation in Music Experiences - Gary W. Schwede (This paper will be delivered during the exhibition)

12:00 - 2:00 CME STUDIO DEMONSTRATION (CME)

2:00 STUDIO REPORTS III (Auditorium)
Chairman: Bruce Rittenbach, CME
Donald Byrd and Rosalee Nerheim, Indiana University
Paul Lansky, Princeton University
John K. Gardner, Brian Harvey, James R. Lawson, and Jear Claude Risset, IRCAM
Jon Appleton, Dartmouth University
David Rosenboom, Berkeley, California

4:30 - 7:30 EXHIBITION SESSION V (Recital Hall)
Tapes

8:00 CME CONCERT (CME)
Pastoral - David Jones
Extended Vocal Techniques Ensemble
Requiem (excerpt) - Deborah Kavasch
Extended Vocal Techniques Ensemble
Loops for Instruments - Robert Erickson
(Computer realization by John M. Grey)
Percussion Loops - Robert Erickson
Ron George, Percussion
** Intermission **
KIVA Ensemble
John Silber, Jean-Charles François

Saturday, October 29

8:30-10:30 COMPOSITIONAL ALGORITHMS (Auditorium)
Chairman: Barry Truax, Simon Fraser University, B.C.
Composing Grammars - Curtis Roads
Further Studies in Interactive Computer Music - Emmanuel
New developments in Stochastic Computer Music - Jon C. S and James N. Siddall

9:30-12:30 EXHIBITION SESSION VI (Recital Hall)
Tapes

Saturday, October 29 (cont.)

10:45-12:30	REAL TIME INTERACTION WITH COMPUTER MUSIC SYSTEMS (Auditorium) Chairman: Gordon Mumma, UC Santa Cruz Envelope Control with an Optical Keyboard - Alice C. Parker and Paul E. Dworak A Microprocessor Based Live Performance Instrument - Michael Yantis A 256 Channel Performer Input Device - Harold G. Alles
2:00	STUDIO REPORTS IV (Auditorium) Chairman: Bernard Rands, UCSD James Beauchamp, University of Illinois Hans Knall, Stockholm, Sweden Pietro Grossi, CNUCE, Pisa, Italy John Melby, University of Illinois Robert Gross, Jean-Charles François and Edwin Harkins, CME
4:00 - 7:00	EXHIBITION SESSION VII (Recital Hall) Tapes and Video
5:00	PAPER: Three Computer Graphics Research Activities Applicable to the Arts - William Fetter (This paper will be delivered during the Exhibition)
8:00	CONCERT (Auditorium) Time Into Pieces - Wesley Fuller, Clark University, Mass. Dwight Peltzer, Piano In Deserto - Jon Appleton, Dartmouth College, New Hampshire Inharmonique - Jean-Claude Risset, IRCAM, Paris Neva Pilgrim Soprano * Intermission * Traveling Music - Loren Rush, Stanford University, California Dwight Peltzer, Piano Plot - Herbert Brün, University of Illinois Jean-Charles François, Percussion Effetti Collaterali - James Dashow, Rome, Italy Philip Rehfeldt, Clarinet

Sunday, October 30

9:00-12:00	EXHIBITION SESSION VIII (Recital Hall) Tapes
9:00	PSYCHOACOUSTICS AND PERCEPTION (Auditorium) Chairman: Gerald Balzano, UCSD A Metric Space Model of Temporal Gestalt Perception - James Tenney Psychoacoustic Aids for the Composer's Exploration of New Material - David Wessel and Bennet Smith
11:00	PANEL: PROBLEMS IN THE USE AND DESIGN OF COMPUTER MUSIC SYSTEMS (Auditorium) Chairman: Robert Gross, CME John Chowning, Stanford University, CCRMA Jean-Claude Risset, IRCAM, Paris Hans Knall, Stockholm, Sweden Barry Truax, Simon Fraser University, B.C. Joel Chadabe, S.U.N.Y. at Albany
2:00 - 5:00	EXHIBITION SESSION IX (Recital Hall) Tapes