FAME—A MICROPROCESSOR BASED FRONT-END ANALYSIS AND MODELING ENVIRONMENT

Jacob D. Rosenbaum and Edward B. Kutin
Higher Order Software
Jericho, New York

FAME, (Front-End Analysis and Modeling Environment) is a micro-processor based interactive computer aided design aid, for designers and developers of computer-based systems. FAME is especially useful in microprocessor applications where systems complexity has increased the need for more rigorous approaches to the development process.

A variety of techniques and methods are being proposed by government and industry to meet the extensive need for better approaches to development, documentation and verification of systems. Some of the more widely used include; formal specification of system requirements and designs, static analysis of related models, and simulation to insure that the system to be developed meets the intended objective. To date, support of these activities involve large, costly computerized systems or extensive manual procedures.
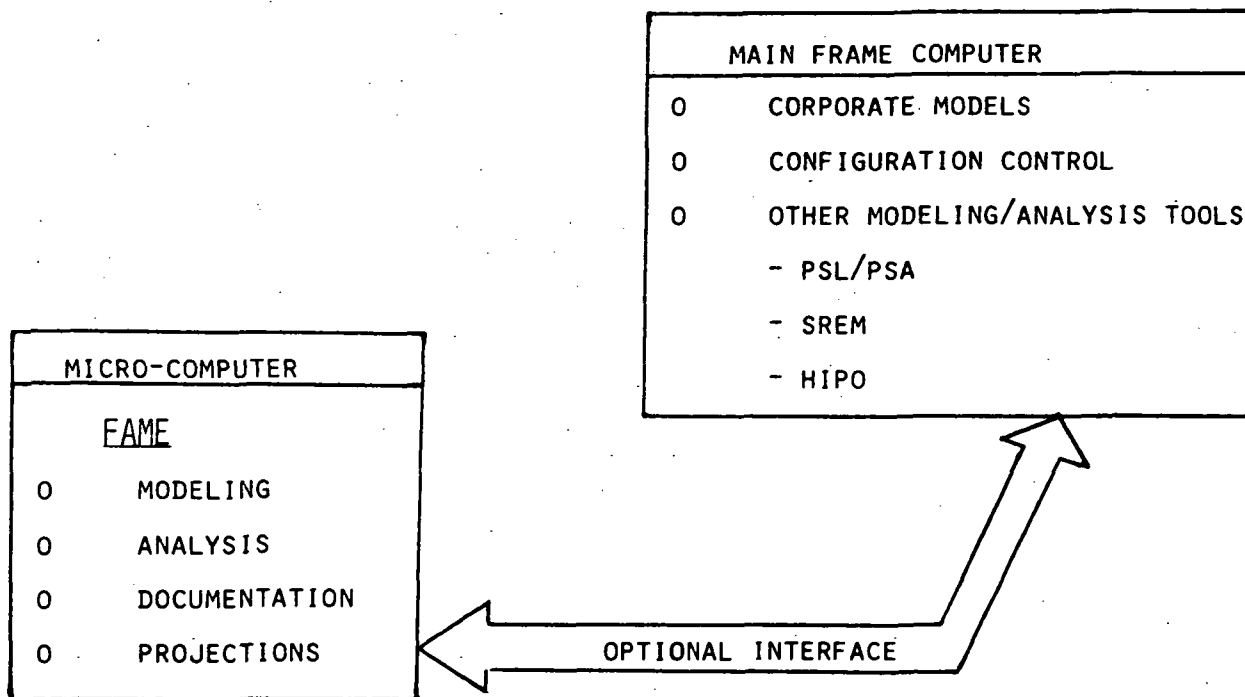
Higher Order Software (HOS) is a methodology for the specification and verification of large scale, complex, real-time systems. An emphasis in its development has been the aerospace environment. Typical systems applications include guidance and control, navigation, communications, radar imaging, satellite tracking and many others. The methodology integrates Functional Decomposition, Abstract Data Types, and Control Structures in accordance with a set of axioms that describe decomposition rules, nodal relationships and responsibilities. The systems models produced can be verified statically using small amounts of computer resources and time.

The HOS methodology has now been implemented as FAME (Front-End Analysis and Modeling Environment), a microprocessor based system for interactively developing, analyzing and displaying system models in a low cost user-friendly environment. The nature of the model is such that when completed it can be the basis for projection to a variety of forms such as Structured Design Diagrams, Petri-Nets, Data Flow Diagrams, PSL/PSA Source Code etc. The user's interface with the analyzer is easily recognized by any current user of a structured modeling approach; therefore extensive training is unnecessary. Furthermore, when all the system capabilities are used one can check on proper usage of Data Types, Functions and Control Structures and thereby add a new dimension to the design process that will lead to better, and more easily verified software designs.

FAME is now available on a range of computer systems as well as on any Microprocessor with 64K of memory and dual floppy disks that can use the CP/M operating system. It is especially useful on Microprocessor Development Systems where one would now be able to combine the requirements, documentation analysis, verification and code development activities on a single device.

FAME CAPABILITIES

```
                                    ┌────────────────────────────────┐
                                    │      MAIN FRAME COMPUTER        │
                                    ├────────────────────────────────┤
                                    │  O    CORPORATE MODELS          │
                                    │                                 │
                                    │  O    CONFIGURATION CONTROL     │
                                    │                                 │
                                    │  O    OTHER MODELING/ANALYSIS TOOLS
                                    │       - PSL/PSA                  │
                                    │       - SREM                     │
                                    │       - HIPO                     │
    ┌──────────────────────┐        └────────────────────────────────┘
    │    MICRO-COMPUTER     │
    ├──────────────────────┤
    │      FAME             │
    │  O    MODELING        │
    │  O    ANALYSIS        │
    │  O    DOCUMENTATION   │
    │  O    PROJECTIONS     │
    └──────────────────────┘
              OPTIONAL INTERFACE
```

BENEFITS OF HOS

O   MODELS ARE VERIFIABLE STATICALLY

O   MODELS INTEGRATE

  - FUNCTIONS

  - DATA TYPES

  - LIBRARIES OF OPERATIONS & STRUCTURES

  - RULES FOR MODEL CREATION

O   SUPPORTS ALL PHASES OF DEVELOPMENT

O   MODELS CAN SUPPORT DIRECT SIMULATION

O   MODELS CAN PROVIDE EXTRACTS TO SATISFY OTHER METHODS

O   AN HOS ANALYSIS REQUIRES KNOWLEDGE OF ONLY A PARENT & ITS OFFSPRING

COST BENEFITS OF FAME ON MICRO

o   OFFLOADS MAINFRAME T/S SYSTEMS

o   PROVIDES GOOD RESPONSE @ < $4/HOUR

o   MINIMUM LINE CHARGES

o   HOS MODELING & ANALYSIS COSTS ESTIMATES (ON 8080 MICROCOMPUTER)

MODELING PHASE	CLOCK MINUTES/NODE	NODES INVOLVED
DECOMPOSITION	15 MIN	PARENTS
ANALYSIS	1.5 MIN	PARENTS
DISPLAY	1.0 MIN	PARENTS

CURRENT STATUS

o   PROTOTYPE (C BASIC) ON 8080 MICRO-COMPUTERS (CPM)

o   PROTOTYPE (C BASIC) ON INTEL MDS

o   PASCAL VERSION ON MICRO (IN DEVELOPMENT)

o   PASCAL VERSION ON VAX 11/780

o   CURRENTLY REHOSTING TO:

       - HARRIS

       - CONTROL DATA (CYBERNET)

       - MULTICS

MODEL OF SATELLITE NAVIGATION SYSTEM
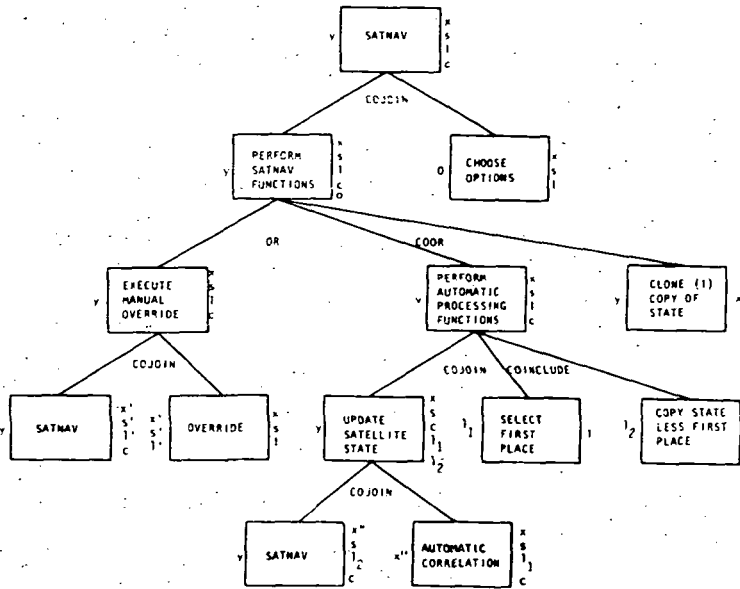
PARENT/OFFSPRING DIAGRAM

HOS/ FRONT-END ANALYSIS AND MODELING ENVIRONMENT

SATELLITE NAVIGATION
SYSTEM

MODEL NAME: SATNAV
AUTHOR: EN
DATE/TIME: 7/14

OUTPUTS   INPUTS

```
                    :-----------:
                    : ABB       :
YSATST              :PERFORM    :    XSATST
                    :AUTOMATIC  :    SSETIM
                    :PROCESSING :    LSETPL
                    :FUNCTIONS  :    CSTSIM
                    :-----------:
                    O=PROC
```

```
:----------:          :----------:             :----------:
: ABBC     :COJOIN    : ABBB     :COINCLUD     : ARBH     :
:UPDATE    :          :SELECT    :             :COPY SET  :
:SATELLITE :          :FIRST     :             :LESS FIRST:
:STATE     :          :PLACE     :             :PLACE     :
:          :          :          :             :          :
:          :          :          :             :          :
:----------:          :----------:             :----------:
```

YSATST   XSATST   LSETPL 1 LSETPL   LSETPL 2 LSETPL
         SSETIM
         CSTSIM
         LSETPL 1
         LSETPL 2

```
-----------------DATA--------------------------------DATA TYPE--PART OF
XSATST   ---> STATE OF  SATELLITES                    STATE
YSATST   ---> STATE OF  SATELLITES                    STATE
SSETIM   ---> ORDERED   SETS OF   IMAGES              ORDSET
LSETPL   ---> ORDERED   SETS OF   PLACES              ORDSET
CSTSIM   ---> ORDERED SETS OF (ORDERED SETS OF IMAGES) ORDSET
LSETPL 2 ---> ORDERED   SET OF    PLACES 2            ORDSET
LSETPL 1 ---> ORDERED   SET OF    PLACES 1            ORDSET


--------------CONDITION---------------
O=PROC  ---> EQUAL(O,PROCEED)


A>
```

164

```
HOW MANY OFFSPRING DO YOU WANT TO ADD?  2
FOR NODE  ABBCA
FN NAME (8 ): AUTOCOR_
OP NAME (8 ): _____
LONG NAME (10 ): AUTOMATIC_
LONG NAME (10 ): CORRELATIO
LONG NAME (10 ): 1_____
CONNECTOR (8 ): _____
INPUT(8): 2_____
INPUT(8): 4_____
INPUT(8): 8_____
INPUT(8): 6_____
INPUT(8): 1_____
OUTPUT(8): XSATST''


FOR OUTPUT XSATST''
DATA TYPE(8): STATE___
LONG NAME(10): STATE_OF__
LONG NAME(10): SATELLITES
LONG NAME(10): 1_____

OUTPUT(8): 1_____
CONDITION (8 ): _____
FOR NODE  ABBCB
FN NAME (8 ): SATNACCV
OP NAME (8 ): _____
LONG NAME (10 ): SATNAV____
LONG NAME (10 ): 1_____
CONNECTOR (8 ): COJOIN__
INPUT(8): XSATST''

INPUT(8): 4_____
INPUT(8): 10_____
INPUT(8): 6_____
INPUT(8): 1_____
OUTPUT(8): 1_____
OUTPUT(8): 1_____
DO YOU WANT TO MAKE ANY CHANGES TO INPUTTED INFORMATION?N
FILES CLOSED---RUNNING UPDATE
PASSWORD ████

UPDATE COMPLETED
```

```
                              :----------:
                              :AA        :
                              :CHOOSE    :
                           --:OPTIONS    :
                           !  :          :
                           !  :          :
                           !  :----------:
                           !
                           !               :----------:
                           !               :ABA       :
                           !               :CLONE(1)  :
                           !             --:COPY OF   :
                           !             ! :STATE     :
    :----------:          !             ! :          :
    :A         :          !             ! :----------:
    :SATNAV    :          !             !
    :          :       :--!             !              :----------:
    :          :       !                !              :ABBA      :
    :          :       !                !              :COPY SET  :
    :----------:       !                !            --:LESS FIRST:
                       !                !            ! :PLACE     :
                       !                !            ! :          :
                       !                !            ! :----------:
                       !                !            !
                       !                !            !
                       !  :----------:  ! :----------:  ! :----------:
                       !  :AB        :  ! :ABB       :  ! :ABBB      :
                       !  :PERFORM   :  ! :PERFORM   :  ! :SELECT    :
                     --:SATNAV    :--! :AUTOMATIC :----:FIRST     :
                       :FUNCTIONS :  ! :PROCESSING:  ! :PLACE     :
                       :          :  ! :FUNCTIONS :  ! :          :
                       :          :  ! :----------:  ! :----------:
                       :----------:  !               !
                                     !               ! :----------:
                                     !               ! :ABBC      :
                                     !               ! :UPDATE    :
                                     !             --:SATELLITE :
                                     !               :STATE     :
                                     !               :          :
                                     !               :----------:
                                     !
                                     !               :----------:
                                     !               :ABCA      :
                                     !               :OVERRIDE  :
                                     !             --:          :
                                     !             ! :          :
                       ! :----------:  !           ! :          :
                       ! :ABC       :  !           ! :----------:
                       ! :EXECUTE   :  !           !
                     --:MANUAL    :--!           ! :----------:
                       :OVERRIDE  :  !           ! :ABCB      :
                       :          :  !           ! :SATNAV    :
                       :----------:  !         --:          :
                                                 :          :
                                                 :          :
                                                 :----------:
```