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Knowledge Representation by Scripts in an Expert Interface

—Paper Presented in Seattle 1986

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Abstract

This report contains a paper presented at the 1986 American Control Conference held in Seattle, Washington, in June 18–20, 1986. The viewgraphs used at the presentation are also included.

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System Identification, Expert Systems, Scripts, Help Systems

Classification system and/or index terms (if any)

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An Expert System Interface for Idpac

by

Jan Eric Larsson
and
Per Persson

Why use an Expert System?

- Systems identification is a well defined problem
- Experts are available
- Idpac is well fitted for the problem
- The problem is not trivial
- The problem is not too large
- An expert system solution seems to be possible

- Program packages

  IDPAC, SYNPAC, MODPAC, SIMNON, ...

- Interactive, command driven

- Based on INTRAC

- Written in FORTRAN, ca. 1973

- IDPAC knows 40 commands

- Complex command syntax

- Brief

  Very efficient

  Cryptic

- E.g.

  CONV *outfile* < *infile* (1 3) 4 1

  RESID *res* < *syst data* 1 4 1

IDPAC commands

1. UTILITIES
   - CONV
   - DELET
   - EDIT
   - FHEAD
   - FORMAT
   - FTEST
   - LIST
   - MOVE
   - TURN

2. GRAPHIC OUTPUT
   - BODE
   - HCOPY
   - PLMAG
   - PLOT

3. FREQUENCY RESPONSE OPERATIONS
   - ASPEC
   - CSPEC
   - DFT
   - FROP
   - IDFT

4. TIME SERIES OPERATIONS
   - ACOF
   - CCOF
   - CONC
   - CUT
   - INSI
   - PICK
   - SCLOP
   - STAT
   - TREND
   - VCOP

5. SIMULATION AND MODEL ANALYSIS
   - DETER
   - DSIM
   - FILT
   - RANPA
   - RESID
   - SPTRF

6. IDENTIFICATION
   - LS
   - ML
   - SQR
   - STRUC

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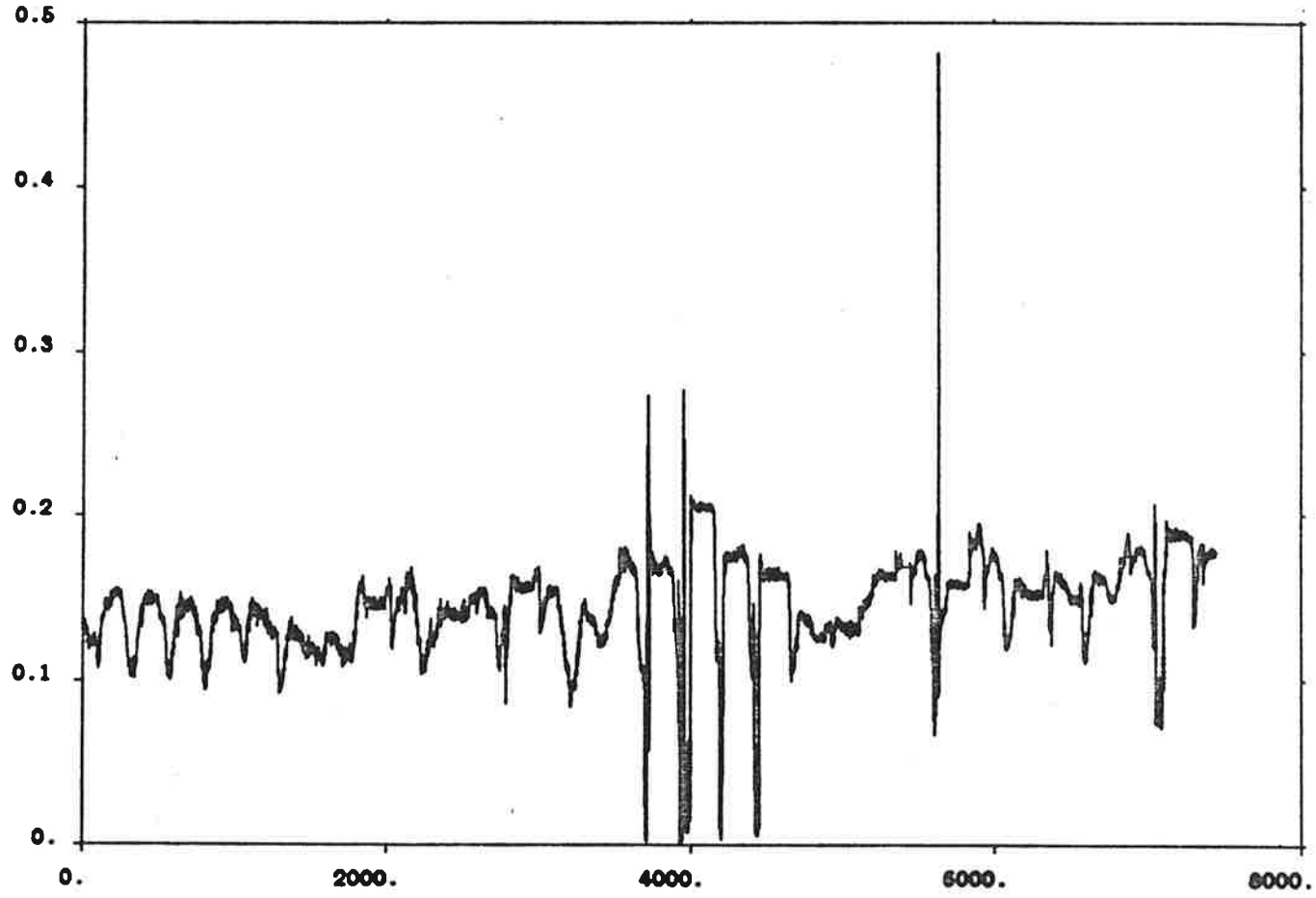

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D5.D;1	D50.D;1	DC14.D;1	DC24.D;1
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DF24.D;1	DF34.D;1	DF44.D;1	DML1.D;1
DML14.D;1	DML2.D;1	DML24.D;1	DML3.D;1
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DML6.D;1	DML7.D;1	DML8.D;1	FLS1.D;1
FLS10.D;1	FLS100.D;1	FLS5.D;1	FLS50.D;1
FML1.D;1	FML10.D;1	FML100.D;1	FML200.D;1
FML5.D;1	FML50.D;1	FMLI1.D;1	FMLI10.D;1
FMLI100.D;1	FMLI5.D;1	FMLI50.D;1	FMODLS.D;1
FR1.D;1	FR2.D;1	FR3.D;1	FR4.D;1
GENMAC.T;4	GENSIG1.T;7	GENSIG2.T;5	IDENTI.T;5
IDENTIF.T;8	IDPAC.SPY;42	IDPAC.T;2	L1.T;1
LS10.T;1	LS100.T;1	LS5.T;1	LS50.T;1
LSINID.T;12	LSIR.D;1	MDFYSIG.T;6	ML1.T;2
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ML24.T;1	ML3.D;1	ML3.T;2	ML34.T;1
ML4.T;1	ML44.T;1	ML5.T;2	ML50.T;1
MLC14.T;1	MLC24.T;1	MLC34.T;1	MLC44.T;1
MLC54.T;1	MLF14.T;1	MLF24.T;1	MLF34.T;1
MLF44.T;1	MLI1.T;1	MLI10.T;1	MLI100.T;1
MLI5.T;1	MLI50.T;1	MLID.T;7	MLIDI2.DS;1
MLIID.T;6	MLI.D;1	MODLS.T;1	PCID.T;4
PFID.T;16	PID.T;10	R134.T;1	R1TFML34.D;3
R234.T;1	R2TFML34.D;1	R334.T;1	R3TFML34.D;1
R434.T;1	R4TFML34.D;1	RAND.T;2	RES.T;9
RESI.T;2	RESULT.T;1	RTFML3.D;1	S1.D;1
S10.D;1	S100.D;1	S200.D;1	S5.D;1
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TFML3.D;1	TFML34.D;1	W4.D;1	WORK4.D;1
WRK.D;1	WRK1.D;1	WWRK.D;1	X.T;3

Total of 140 files.

- IDPAC's commands are hard to remember

- Help - gives only name and syntax

- The result strongly depends on the user's knowledge

- Demands on a good help system

  When to use a command

  How to combine commands

  A goal related help function,
  help on methods,
  a dynamic (= fancy) help function

- Different types of dialog

  Question and answer dialog

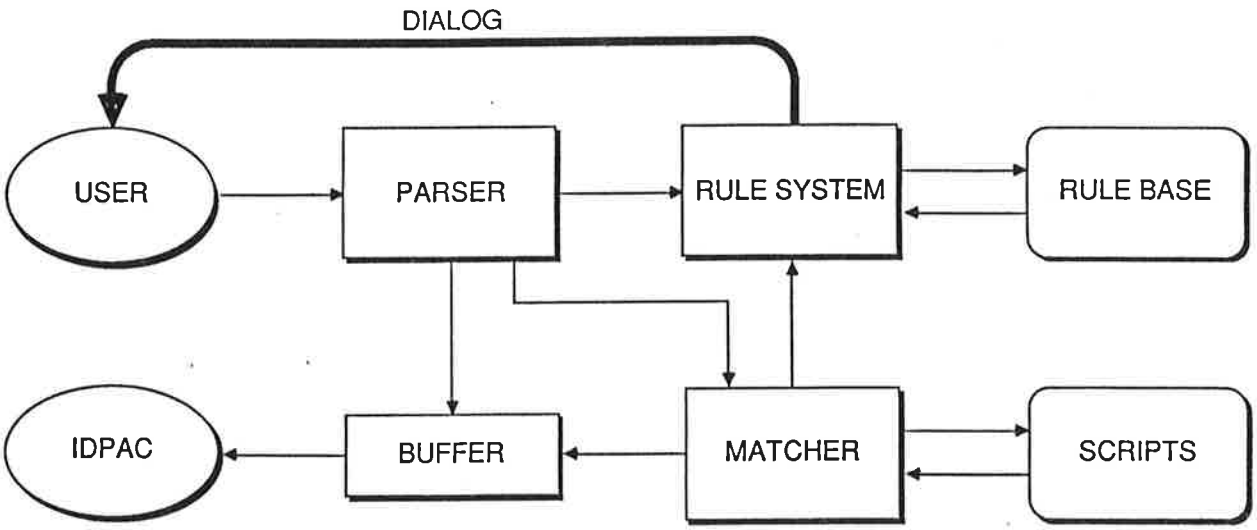
  Command style dialog

- We want something in between

  Normal command dialog, sometimes the help system comes into action

  "The commmand spy"

An implementation of the command spy



- Parser
- Matcher
- Expert system

- Lisp
- VT100 graphics

(plot x) Command sent
(ml1 ml2 ml3 ml4 corana data-analysis)
(plmag (plot trend) acof stat)
Rule ml1-1 deduces: (write: "If there are any outliers, remove them with PLMAG") Rule ml1-4 deduces: (write: "If there are any trends, remove them with TREND") Rule corana-1 deduces: (write: "In analysis use ACOF-PLOT, ASPEC-BODE and DFT-BODE")
IDPAC> conv x < y 1 IDPAC> plot x IDPAC>

Scripts

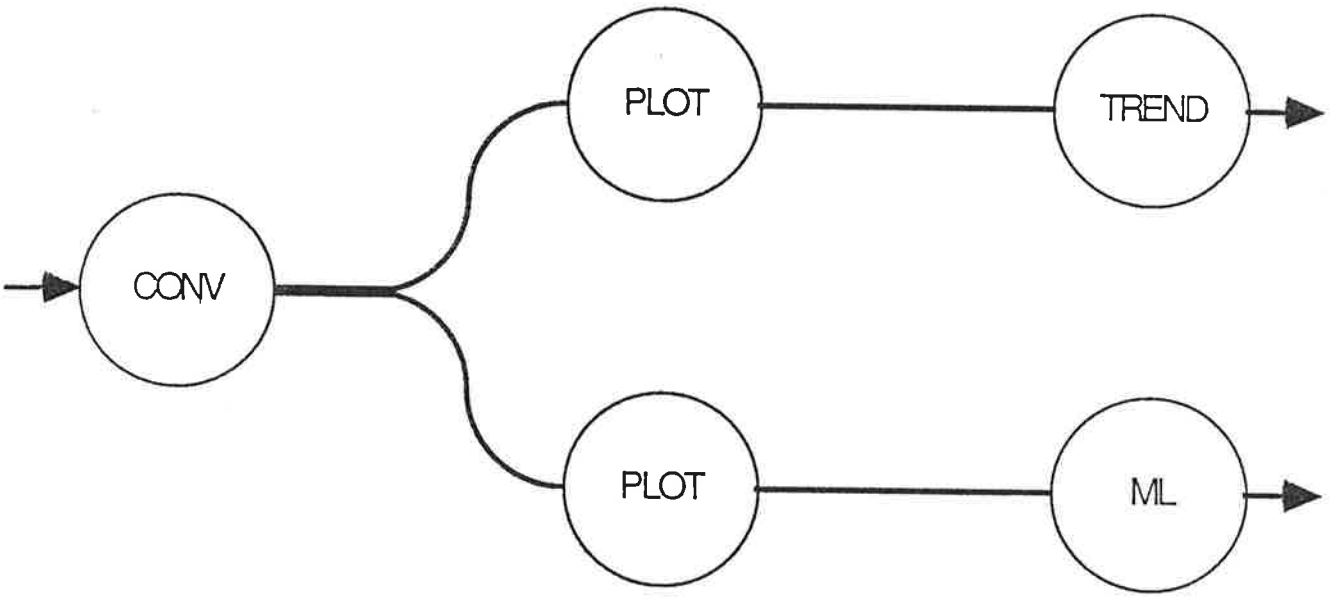
- Different constructs

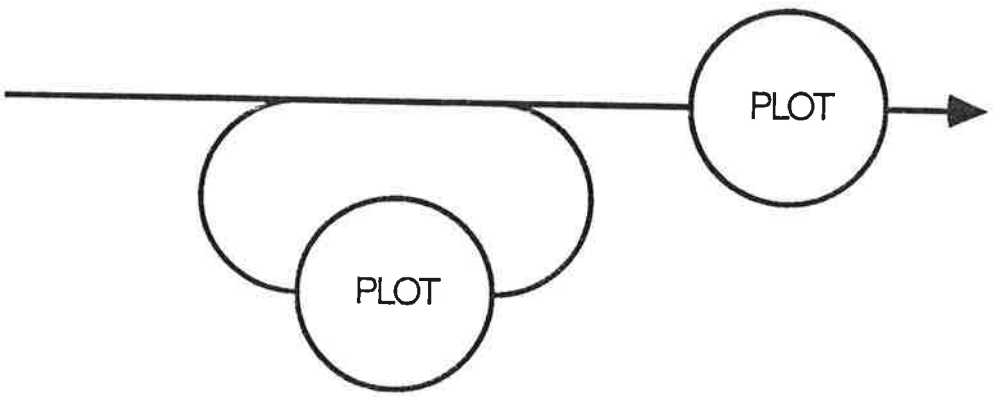
  command
  production system call
  script procedure
  repetition
  or
  all

```
(conv
 plot
 trend
 (repeat (
   ml
   (repeat (
     (or (resid) (sptrf bode))))))
 stop)
```

Script Matching

- The script language is very general.
- The users will develop new scripts.
- Pattern matching.





Building blocks

Flavors

- Object oriented programming in Lisp
- Multiple inheritance
- Originates from MIT

YAPS

- Forward chaining framework
- Uses Flavors
- Developed at University of Maryland

- A small system has been developed.
- Design and implement the new system.

  Programming with object oriented methods in Lisp.
- Build a realistic knowledge base.

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YAIR—Yet Another Internal Report