DESKTOP COMPUTING POWER FOR THE DESIGNER

Hewlett-Packard offers a broad line of computing equipment and software packages for the electronic designer. No longer must you plod through hand calculations and pencil annotations, nor must you consume valuable time coding and punching cards and interfacing with the often rigid hierarchy of computer input requirements. Today you can solve your design problems on an easy-to-use desktop computing calculator. The HP 9825A sits right on your desk, ready for instant use and accurate EE answers.

CONVENIENCE AND CAPABILITY

The 9825 is a power-packed unit with performance built into each keystroke.

- HPL, the high level programming language of the 9825, offers you the power and efficiency for handling equations, data manipulation, and input/output operations.
- The high speed data cartridge, which is small enough to fit in your pocket, stores up to 250k bytes of program or data. What's more, its average access time is just 6 seconds.
- The proprietary NMOS processor provides high-speed number processing, which quickly gives you the results you want.
- The "live keyboard" allows you to use the calculator for a variety of operations, including arithmetic calculations, at the same time a program is running.

The basic 9825 operating system, which is made up of 24k bytes of NMOS Read-Only Memory (ROM), runs the keyboard, 32-character LED, printer, and cartridge, and includes the HPL firmware. Another 6844 bytes of user Read/Write Memory (RWM) is available for writing your own applications programs. If you need expansion capabilities, the user RWM can be expanded to 32k bytes. ROM's can also be added to extend the language capabilities.

With the 9825 you now have the power to handle both the usual and unusual problems in your scientific and engineering applications.

CALCULATOR-AIDED DESIGN IN ELECTRONICS

Solving loop equations by hand is fun, right? And now you want a Bode plot of the frequency response? Does a network analysis program complete with Bode plots sound attractive? The 9825 Calculator Network Analysis Program (CNAP) allows you to spend more time creating and less time analyzing. This software has been created to help you in design and analysis of your analog circuits.

The program has been patterned after the well-known ECAP Circuit Analysis Program written by IBM. Features of CNAP are:

- Up to 18 nodes and 96 components can be analyzed with 15,036 bytes of memory. With the standard memory of 6844 bytes, up to 9 nodes and 48 components can be analyzed.
- Components allowed are resistors, capacitors, inductors, and voltage-controlled current sources.
- Actual tolerances of components can be entered. You can get a band of circuit responses based on these tolerances.
- Simulate other circuit elements. The precision and dynamic range of the 9825 make it possible to transform op amps, transistors, etc. into the required form.
- Data input is simplified. You need only specify the component type, value, and node interconnection.
- Circuit topologies can be stored on the cartridge for later use.
- Analysis can be performed on either a basic machine or an expanded machine without buying a new program.
- Output can be plotted on the HP 9862A Plotter, HP 9866B Thermal Line Printer, or HP 9871A Printer/Plotter.
- Log or linear sweep analysis can be performed.
- You don't have to reenter all of the data when you change components or the analysis.
- The magnitude of the output voltage (in dB), the phase, and the time delay may be printed and/or plotted at specified frequencies.

Take your circuit, model it, and examine the frequency response with the values and tolerances you specify. Circuits containing active components such as active filters can easily be modeled and analyzed. If the computed response is not the one you want, simply press a Special Function key and enter new values for any of the components. Run the analysis again, and in a short time you have all the information you want. Most important of all, the complete solution can be documented in both tabular and graphic form. No other bookkeeping is necessary.

THE 9825 HARDWARE/SOFTWARE CONFIGURATION

The powerful 9825 AC Circuit Analysis software is available from HP as Part Number 09825-12500. The package consists of:

- A complete prerecorded cartridge with programs for both the basic and the expanded versions.
- A keyboard template overlay (see illustration) for use with the Special Function keys in program operation.
- A comprehensive instruction manual which contains detailed operator instructions, examples, and program theory information.

The equipment necessary to use the software consists of:

- HP 9825A Calculator with 6844 bytes of memory.

Optionally the program is set up to use:

- HP 9825A Calculator with 15,036 bytes of memory (Opt. 001)
- HP 9862A Plotter, or
- HP 9871A Printer/Plotter, or
- HP 9866B Thermal Line Printer.

CAD - THE TIME SAVER

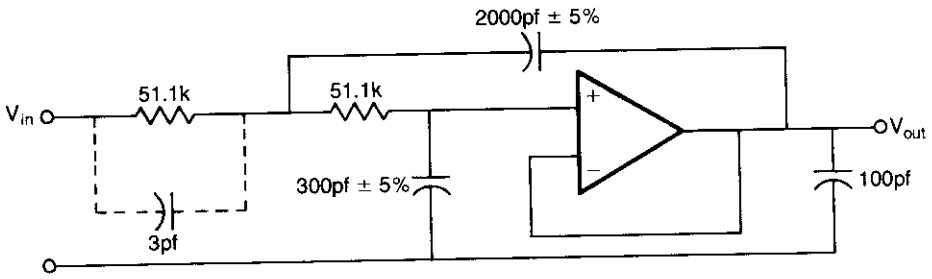
If your design problem is too troublesome for manual analysis but does not warrant the time and expense of a computer, try the HP Calculator-Aided Design solution. It can save you time and money and give you hands-on accessibility and accurate answers in just a few minutes. HP can help you take the drudgery out of your work and give you more design time.

The 9825 CNAP software package can be ordered through your local HP Field Engineer. Ask for Part Number 09825-12500.

Circuit Analysis on the HP 9825A

HEWLETT hp PACKARD

EXAMPLE OF CIRCUIT ANALYSIS



Bread Board Circuit Schematic

OPERATIONAL AMPLIFIER CHARACTERISTICS

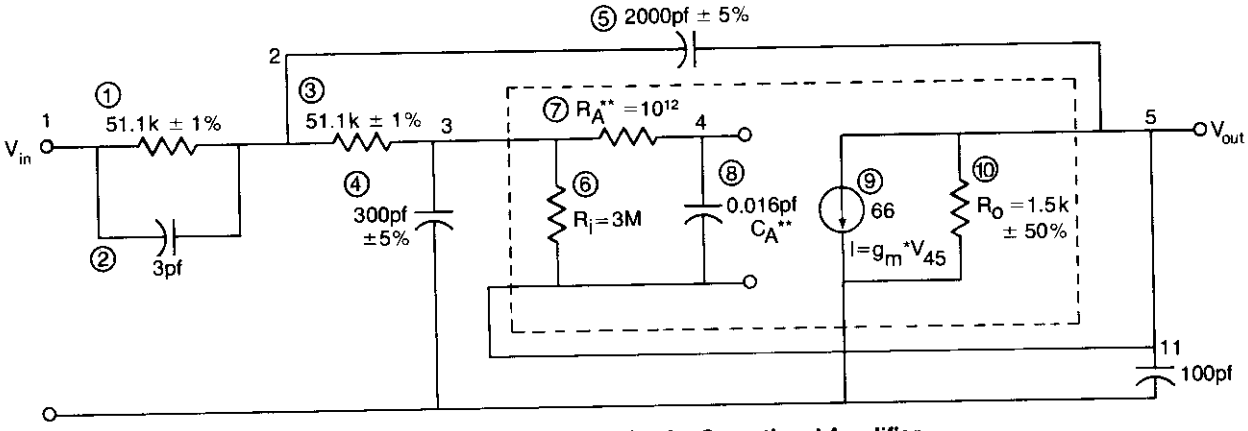
$R_i = 3M$

$R_o = 1.5K \pm 50\%$

$A_{vol} = \frac{A_o \omega_A}{j\omega + \omega_A}$

$A_o = 100{,}000$

$\omega_A = 60$ rad/sec



Schematic Including Model for the Operational Amplifier

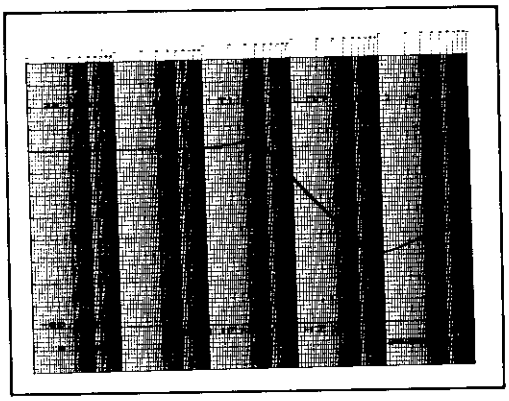
* The current source is set to give a low frequency gain of $g_m R_o = A_o$, i.e. $g_m = 100{,}000/1500 = 66$.

** The frequency response of the amplifier is simulated by R_A and C_A; selecting $R_A = 10^{12}\ \Omega$ results in C =0.016pf since $C_A = 1/(\omega_A \cdot R_A)$.

```
DATA FILE:      17
IDENTIFIER NO.
            4276

NO.NODES=        5

NO.BRANCHES     11

BRANCH           1
  RESISTOR
  Kohms= 51.1000
  FROM NODE      1
  TO NODE        2

BRANCH           2
  CAPACITOR
  pfd=     3.0000
  FROM NODE      1
  TO NODE        2


BRANCH           8
  CAPACITOR
  pfd=     0.0160
  FROM NODE      4
  TO NODE        5

BRANCH           9
  SOURCE
  amps=   66.0000
  FROM NODE      5
  TO NODE        0
  + CONTROL      4
  - CONTROL      5

BRANCH          10
  RESISTOR
  Kohms=   1.5000
  FROM NODE      5
  TO NODE        0

BRANCH          11
  CAPACITOR
  pfd=   100.0000
  FROM NODE      5
  TO NODE        0
```

```
NO. OF TOLERANCE
 PASSES         20
OUTPUT NODE      5
  LOG SWEEP
X AXIS DATA:
  STARTING FREQ=
                10
  ENDING FREQ.=
           1000000

  # OF INTERVALS
                40


LOWER ENVELOPE

                4276


FRQ          10.00
MGN           0.00
PHS          -0.11

FRQ          13.34
MGN           0.00
PHS          -0.15
TDL    0.00002920

FRQ          17.78
MGN           0.00
PHS          -0.20
TDL    0.00002920

FRQ          23.71
MGN           0.00
PHS          -0.27
TDL    0.00002920

FRQ          31.62
MGN           0.00
PHS          -0.36
TDL    0.00002920
```

```
UPPER ENVELOPE

FRQ      316227.77
MGN         -41.02
PHS         -48.08
TDL 0.0000003915

FRQ      421696.50
MGN         -38.95
PHS         -36.61
TDL 0.0000003020

FRQ      562341.32
MGN         -37.09
PHS         -25.05
TDL 0.0000002284

FRQ      749894.21
MGN         -35.48
PHS         -14.11
TDL 0.0000001620

FRQ     1000000.00
MGN         -34.15
PHS          -4.70
TDL 0.0000001046


****************

MAGNITUDE PLOT
IN db

Y AXIS DATA:

  Y MIN=
        -80.00000
  Y MAX=
         20.00000

UPPER ENVELOPE

LOWER ENVELOPE
****************
```



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