TEX and Its Versatility in Office Production

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ABSTRACT

Probably the two most challenging situations an office administrator faces are: 1) strategies to maximize the efficiency, and 2) planning for increased output. Over the past ten years, tremendous changes have occurred: the PC has literally replaced the word processor which previously had replaced the typewriter; fax machines can now send documents faster than special overnight mailing services; photocopiers, built for speed and efficiency, are overwhelming as they devour tons of paper in mere seconds. In the face of all these advancements, secretaries have been expected to adapt to and accept all these changes.

But with the various types of PCs came the problems of selecting the right type of software, drivers, printers, and fonts. The costs alone for upgrading software and equipment are high — especially when an office needs three or four different software programs for word processing, graphics, spreadsheets, and databases. When the Department of Mechanical and Materials Engineering at Washington State University was in the process of upgrading their existing computer and word processing facilities, much thought was given to these problems. It was decided to utilize a program which was already installed on the mainframe, TEX, and build everything else around TEX. The department has been using TEX and *TEXT1* (a program developed by WSU based on TEX) for the past four years. The focus of this paper is on the integration of TEX and *TEXT1* into the office workplace.

During the early 1980s, the Department of Mechanical and Materials Engineering at Washington State University developed a comprehensive Strategic Planning Guide. This Guide reflected the goals and strategies necessary to meet the demands of a growing department. One of the fundamental issues was that of academic computing (i.e., research and instruction), and the need for more computers and modern computer facilities for faculty and students. As monies were appropriated for computer growth and expansion, the Department began to hire new faculty with strong backgrounds in computers. However, it was soon apparent that the existing word processing facilities were not adequate to handle the large typing loads. At that time the Department owned several IBM typewriters and an IBM Mag Card II which was shared by the department's two technical secretaries. The Department decided to upgrade to state-of-the-art word processing equipment and purchased two IBM Displaywriters.

The impact was felt immediately as secretarial workloads were handled more efficiently and the processing time for typing requests were cut nearly in half. The new equipment was relatively easy to use and the staff were very enthusiastic about working with the new word processing stations. However, the Displaywriters were cumbersome when it came to typing mathematical equations and other technical material, and there was very little written documentation available on this topic. Through trial and error, the secretarial staff devised a method for typing equations on the Displaywriter, but the technique was awkward and tedious.

In 1984, the Department conceded that its office equipment was antiquated. The personal computer industry had completely replaced the more conventional word processing systems. The only possible solution was to integrate personal computers into the office system. However, there were so many

different models of personal computers on the market, along with the various types of software, drivers, printers, and other hardware. The variety in software opened up new areas of office development: databases for compiling mailing lists and reports, spreadsheets for budgets and other accounting needs, and graphics for tables, charts and slides. The Department realized it needed to re-evaluate the role of its administrative office and address these new areas. The faculty also voiced their opinions about what types of software and hardware they wanted the office staff to use, and it soon became apparent that this was going to become very expensive. It was about this time that one of the secretaries, Jo Ann Rattey, discovered a solution to the personal computer problem.

She had agreed to type a 45-page appendix containing complex equations and tables for a doctoral candidate's dissertation. The doctoral student had been using a program on the mainframe called T_EXT1 to type his dissertation. He showed her samples of his work and she quickly realized that this program could easily solve many of her own problems regarding technical typing. She showed these samples to departmental chair and the office supervisor, and they agreed to give the program a try. The secretary spent the next several weeks learning the fundamentals of T_EX and T_EXT1, and using a computer terminal installed in her office, typed a few short proposals and papers. The faculty raved about the professional quality of their proposals and papers, and insisted that training sessions be conducted. Another feature that made T_EX and T_EXT1 very desirable was the fact that all users had free access to the software. This alone meant considerable savings since the only equipment needed to use T_EX and T_EXT1 was a computer terminal connected to the mainframe and the training/reference manuals. At this point in time, personal computers were still very expensive and the Department was trying to equip every faculty and staff office with a connection to the mainframe.

When the personal computers were finally installed in the main office, they were linked to the mainframe with a terminal emulator. This greatly added flexibility in that work could now be processed either using MicroSoft Word or the two typesetting programs on the mainframe. At first little, if any, work was done using MS Word on the PCs because Word was not equipped to handle technical typing. In fact, MS Word was behind the Displaywriter software when it came to technical typing. Of course, there were additional software packages available to interface with Word and make technical typing possible, but the main goal of the Department was to avoid spending a lot of money on different software. Therefore, with free access to T_EX and T_EXT1 on the mainframe, it did not make sense to purchase additional software to interface with MS Word.

One particular problem did come up which made it necessary to decide whether all material should be typeset on the mainframe. The Computing Center decided to install new IBM laser printers in several locations on campus and to charge all users a flat rate per page printed. This resulted in the Department incurring an average of $600.00 in monthly printing charges. It was decided to use Word for non-technical material, i.e., letters, and memos. This decision was also beneficial to the majority of the faculty who typed their own correspondence and submitted their disks to be formatted and printed on the small HP LaserJets in the main office. All other material (reports, papers, proposals, slides, and exams) would be typeset using T_EX and T_EXT1.

Interestingly, as the secretaries became more experienced using T_EX and T_EXT1, they began to experiment by typesetting brochures, programs, slides, bar charts, flow charts, and other things normally sent out to the Publications and Printing Office (see Appendix A for sample formats). The department quickly discovered that documents could be produced in-house approaching the quality available from Publications and Printing. However, special needs quickly surfaced: for example, how to integrate graphics into typeset documents. The department's Assistant for Computer Services, Mike Shook has modified Tektronics' PLOT10-TCS sub-routine package to generate files which can be used by T_EXT1 and printed on an IBM 3820 page printer. He has also been using PC image processing software in conjunction with a TV camera/frame grabber which creates PSEG 3820 files which T_EXT1 can use to produce full page images. Now text and graphics can be compiled into one T_EX file and printed. This feature has resulted in less dependence on the College of Engineering's Design Office, and allows the user to control the design content.

The department felt that a database software package was a good investment, and dBASE III was purchased. However, it was soon discovered that T_EX and T_EXT1 would not interface with database software. This became critical when a faculty member wanted to send material to an extended list of addresses stored on a 5.25" floppy. The addresses were uploaded to the mainframe and put into a

TEX file. The file was quickly formatted using *TEXT1* commands and printed out on plain bond paper in a three-column format (see Appendix B for sample file), and xeroxed onto address labels. dBASE was used to add delimiters to the original address file on the floppy disk and merged into a shell letter typed with Word. Although this process seems complicated, it actually took less than one hour to print out over 100 letters and addresses.

Recently, the department purchased new HP LaserJet printers and connected them to the mainframe via Gandalf boxes. These boxes make it possible to switch the printers from parallel to serial ports at the touch of a finger, thus allowing the user to print from either the PC or the mainframe. In order to print from the mainframe, the Computing Center had to establish each HP printer as a separate print destination and an access file had to be established on each user's account. The access file allows the user to print from the mainframe and controls who may use the printer.

The major advantage of printing on the LaserJets is that there are no monthly printing charges, and this has resulted in a further drop in departmental printing charges. There are three problems, however, in using the HP LaserJets to process TEX files: 1) Hewlett Packard does not support the IBM Sonoran fonts; 2) the printers are slower than the IBM 3820 and 3812 printers, and 3) the `texdvi` file does not allow selective printing of pages. As it stands now, the font that is supported by HP — the Computer Modern font is adequate for most printing needs — but it is hoped that these problems will be corrected within the next few years.

Appendix A: Sample T_EXT1 Formats for Creating Flow Charts

```
    ....
\notitlepage
\drawboxmat{10pt}
\drawboxrulesize{1pt}
\line{\hfill{\drawbox{\vbox{\hsize=1in{Assume \lbr \hs{10pt} @P_{E_o} =
        P_E@}}}}\hfill}
\vs{-2pt}
\cl{@\downarrow@}
\line{\hs{2.1in}\drawbox{\vbox{\hsize=1.8in{Calculate @\Delta P_{E_o}@
        \lbr \hs{15pt} from @(\Delta P_E/\Delta P_{E_o})@}}}\raise15pt
        \hbox to .7in{ \leftarrowfill@\Delta P_E@}\hfil}
\vs{-2pt}
\cl{@\downarrow@}
\line{\hfill{\drawbox{\vbox{\hsize=1.8in{Calculate gas flow\lbr\hs{15pt}
        velocity using @\Delta P_{E_o}@}}}\hfill}
\vs{-2pt}
\cl{@\downarrow@}
\line{\hfill{\drawbox{\vbox{\hsize=1.8in{Calculate @\Delta P_{T_o}@\lbr
        \hs{15pt} using gas velocity}}}}\hfill}
\vs{-2pt}
\cl{@\downarrow@}
\line{\hs{2.1in}\drawbox{\vbox{\hsize=1.9in{Calculate @\Delta P_T/
        \Delta P_{T_o}@\lbr\hs{32pt} and evaluate Z}}}\raise15pt
        \hbox to .7in{ \leftarrowfill  @\Delta P_T@}\hfill}
\vs{4pt}
\hs{1in} Z not converged
\vs{2pt}
\cl{@\bigcirc@}
\line{\hs{3.044in} @\Bigg\downarrow@ \raise1pt\hbox{Z converged}\hfil}
\line{\hfill{\drawbox{\vbox{\hsize=1in{Stop and \lbr\hs{17pt} print out}}}}
\hfill}
    ....
%  Default page dimensions and margins
\pageformat{\pagelength{11in}     % 792pt = 11in
            \pagewidth{8.5in}     % 612pt = 8.5in
            \topmargin{1in}       % 72pt = 1in
            \bottommargin{1in}
            \leftmargin{.50in}    % 86pt = 1.2in
            \rightmargin{.50in}
            \bindingadjust{0in}
}% end pageformat
\normalbottom                     % text height will be the same for each page.
                                  % Bottom lines will be even.
% Specific Font for Computer Modern Sans Serif
\ssf{cmss}{9}{11pt}
% Markup for Document ==> \cmss9; (implies \isk{11})
%
% Specific Font for Computer Modern Sans Serif
\ssf{cmss}{10}{12pt}
% Markup for Document ==> \cmss10; (implies \isk{12})
%
\cmss9;
\def\boxit#1{\drawbox{\vbox to 40pt{\vfill#1\vfill}}}
```

```
\hs{144pt}\boxit{\hsize=.56in \nin Develop\lbr Target \lbr Specs}
\vs{.50in}
\line{\boxit{\hsize=.6in \nin Recognize \lbr a \lbr Need}
   \hfill
   \boxit{\hsize=.6in \nin Set \lbr Design\lbr Objectives}
   \hfill
   \boxit{\hsize=.6in \nin Create\lbr Alternative\lbr Designs}
   \hfill
   \boxit{\hsize=.6in \nin Screen to\lbr Satisfy\lbr Objectives}
   \hfill
   \boxit{\hsize=.6in \nin Select\lbr ``Best''\lbr Design}
   \hfill
   \boxit{\hsize=.6in \nin Prepare \lbr a \lbr Model}
   \hfill
   \boxit{\hsize=.6in \nin Test and \lbr Evaluate \lbr Model}
   \hfill
   \boxit{\hsize=.6in \nin Communi- \lbr cate the \lbr Design}}
\vs{.50in}
\line{\hs{100pt}
     \boxit{\hsize=.61in \nin Gather \lbr the \lbr Information}
     \hs{100pt}
     \boxit{\hsize=.61in \nin Improve\lbr the\lbr Design}
     \hfill}
\vs{1in}
\cl{The Expanded Design Process - 11 Step.}
   ....
\paragraphindent{18pt}\paragraphskip{12pt plus 6pt minus 1pt}
\justify     \singlespace
\normalbottom
\selectfontset{cm12}{defaultprop}{default} %
\defaultprop\rm
\selectfontset{cm10}{tablefont}{default} %
\selectmathset{cm97m}{mathdefault} %
\mathdefault
\notitlepage
\sfs{cmsan11}{elevenptss}{13pt}  \sfs{cmsan8}{eightptss}{10pt}
\def\leaderfill{\leaders\hrule height2pt \hfill}
{\offinterlineskip
\tablefont
\halign{\strut\lft{#}\hfil& \vrule# &\hs{2pt}{#}&\hs{2pt}{#}&\hs{2pt}{#}&
       \hs{2pt}{#}
       &\hfil \vrule# &\hs{3pt}{#}&\hs{2pt}{#}&\hs{2pt}{#}&\hs{2pt}{#}&
       \hfil\vrule#
       &\hs{3pt}{#}&\hs{2pt}{#}&\hs{2pt}{#}&\hs{2pt}{#}& \hfil \vrule#\hfil\cr
&& \multispan{14} Months & \cr
&& && && && && && && \cr
Activity && J & F & M & A && M & JU & JL & A && S & O & N & D &\cr
&& && && && && && && \cr
\noalign{\hrule}
&& && && && && && && \cr
ISC sub-project: && && && && && && && &&\cr
&& && && && && && && \cr
A. feature abstraction update && \multispan5\leaderfill &&&& \multispan5
\leaderfill && \cr
```

```
B. engagement abstraction update && \multispan5\leaderfill &&&& \multispan5
\leaderfill&&\cr
C. run time environment design update && \multispan3\leaderfill && && && && && &
&\cr
D. run time environment hardware and software update &&  & \multispan6
\leaderfill && && && &&\cr
E. control system design && \multispan3 \leaderfill && && && && && && \cr
F. implement control algorithm && && && &\multispan4 \leaderfill && && &&\cr
G. ISC system testing && && && && &&\multispan5\leaderfill&&\cr
&& && && && && && && &&\cr
Process models sub-project: && && && && && && && && \cr
&& && && && && && && && \cr
H. process model development && && &\multispan5\leaderfill && && && & \cr
I. mechanistic model parameter investigation &&\multispan{10}\leaderfill && && &
 \cr
J. control/process model system simulation&& &&\multispan8\leaderfill && && &
\cr
&& && && && && && && &&\cr
Sensor sub-project: && && && && && && && &&\cr
&& && && && && && && &&\cr
K. design of AE fluid coupled sensor for CNC mill &&\multispan3 \leaderfill && &
& && && && && \cr
L. fabrication of AE sensor && &&\multispan4\leaderfill && && && && & \cr
M. develop AE sensor monitoring environment for ISC && &&\multispan5 \leaderfill
 && && && &&\cr
N. investigate AE signal for end mill surface generation && && && && &
\multispan6
\leaderfill && \cr
O. fabricate OM-2 force sensing system && && && && &\multispan3 \leaderfill && &
& &\cr
P. calibrate and test force sensing system && && && && && && \multispan4
\leaderfill &\cr
&& && && && && && && &&\cr
OM-2 installation sub-project:&& && && && && && && &&\cr
&& && && && && && && &&\cr
Q. complete mechanical and hydraulic installation && \multispan2\leaderfill && &
& && && && &\cr
R. install contollers && &\multispan5\leaderfill && && && && &\cr
S. initialize controller logic and test system && && && && &\multispan6
\leaderfill &&\cr
T. prepare final report && && && && && && &\multispan2\leaderfill &&\cr
&& && && && && && && &&\cr
\noalign{\hrule}}}
    ....
% Default page dimensions and margins
\pageformat{\pagelength{11in}   % 792pt = 11in
          \pagewidth{8.5in}   % 612pt = 8.5in
          \topmargin{1in}     % 72pt = 1in
          \bottommargin{1in}
          \leftmargin{.75in}  % 86pt = 1.2in
          \rightmargin{.75in}
          \bindingadjust{0in}
}% end pageformat
\normalbottom                 % text height will be the same for each page/
```
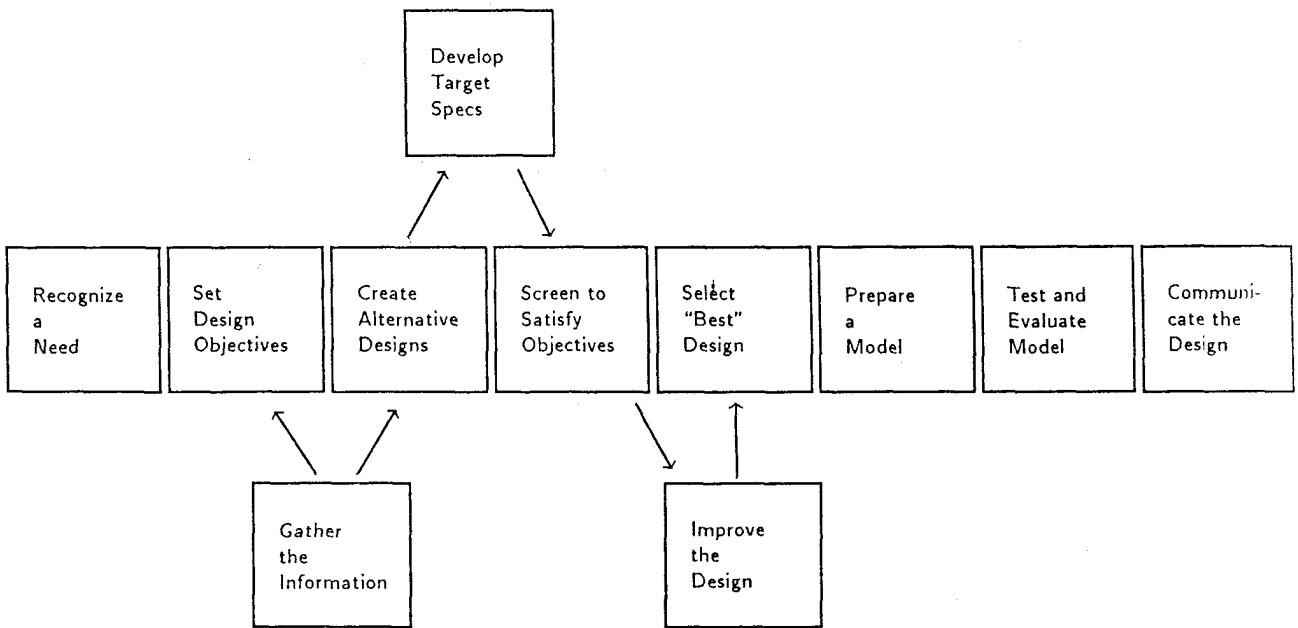
```
                              % Bottom lines will be even.
\notitlepage
\pin{0pt}
\cl{\bf{MECHANICAL \& MATERIALS ENGINEERING}}
\cl{\bf{ORGANIZATIONAL CHART}}
\vs{10pt}
\drawboxmat{10pt}
\drawboxrulesize{2pt}
\line{\hfill{\drawbox{\vbox{\hsize=2.1in {\nin\bf{DEPARTMENT CHAIR}}}}}\hfill}
\vs{-5pt}
\cl{@\Bigg\downarrow@}
\vs{2pt}
\line{\hfill{\drawbox{\vbox{\hsize=.8in{FACULTY}}}}\hfill}
\vs{2pt}
\newbox\arrow \setbox\arrow=\hbox{@\downarrow@}
\def\da{\lower8pt\copy\arrow}
\line{\hfill\da
    \hs{-1.2\wd\arrow}
    \vrule width 2in height .4pt depth 0pt
    \vrule width .4pt height 10pt depth 0pt
    \vrule width 2in height .4pt depth 0pt
    \hs{-1.2\wd\arrow}
    \da\hfill}
\vs{2pt}
\line{\hs{18pt}{\drawbox{\vbox{\hsize=1.8in{GRADUATE STUDIES\vs{0pt}
      COMMITTEE (ME)}}}}\hfill {\drawbox{\vbox{\hsize=1.5in{SECRETARY
      IV}}}} \hs{32pt}}
\vs{2pt}
\line{\hfill - Office Staff \hs{24pt}}
\vs{8pt}
\line{\hs{18pt}{\drawbox{\vbox{\hsize=1.8in{\nin GRADUATE STUDIES\vs{0pt}
      COMMITTEE (MSE)}}}}\hfill {\drawbox{\vbox{\hsize=1.9in {ASSISTANT
      FOR\vs{0pt}COMPUTER SYSTEMS}}}} \hs{4pt}}
\vs{8pt}
\line{\hs{11pt}{\drawbox{\vbox{\hsize=1.9in{UNDERGRADUATE \vs{0pt} STUDIES
      COMMITTEE}}}}\hfill {\drawbox{\vbox{\hsize=2in {ASSISTANT
      FOR\vs{0pt}RESEARCH FACILITIES}}}}}
\vs{8pt}
\line{{\drawbox{\vbox{\hsize=2.05in{LABORATORIES, EQUIP-\vs{0pt}MENT \&
      FACILITIES\vs{0pt} COMMITTEE}}}}\hfill {\drawbox{\vbox{\hsize=1.75in
      {PROGRAM \vs{0pt}ASSISTANT III:\vs{0pt} STUDENT SERVICES}}}} \hs{13pt}}
\vs{8pt}
\line{\hs{60pt}{\drawbox{\vbox{\hsize=1.2in{SAFETY \vs{0pt}
      COMMITTEE}}}}\hfill {\drawbox{\vbox{\hsize=2in {TECHNICAL
      SERVICES\vs{0pt}SUPERVISOR}}}}}
```
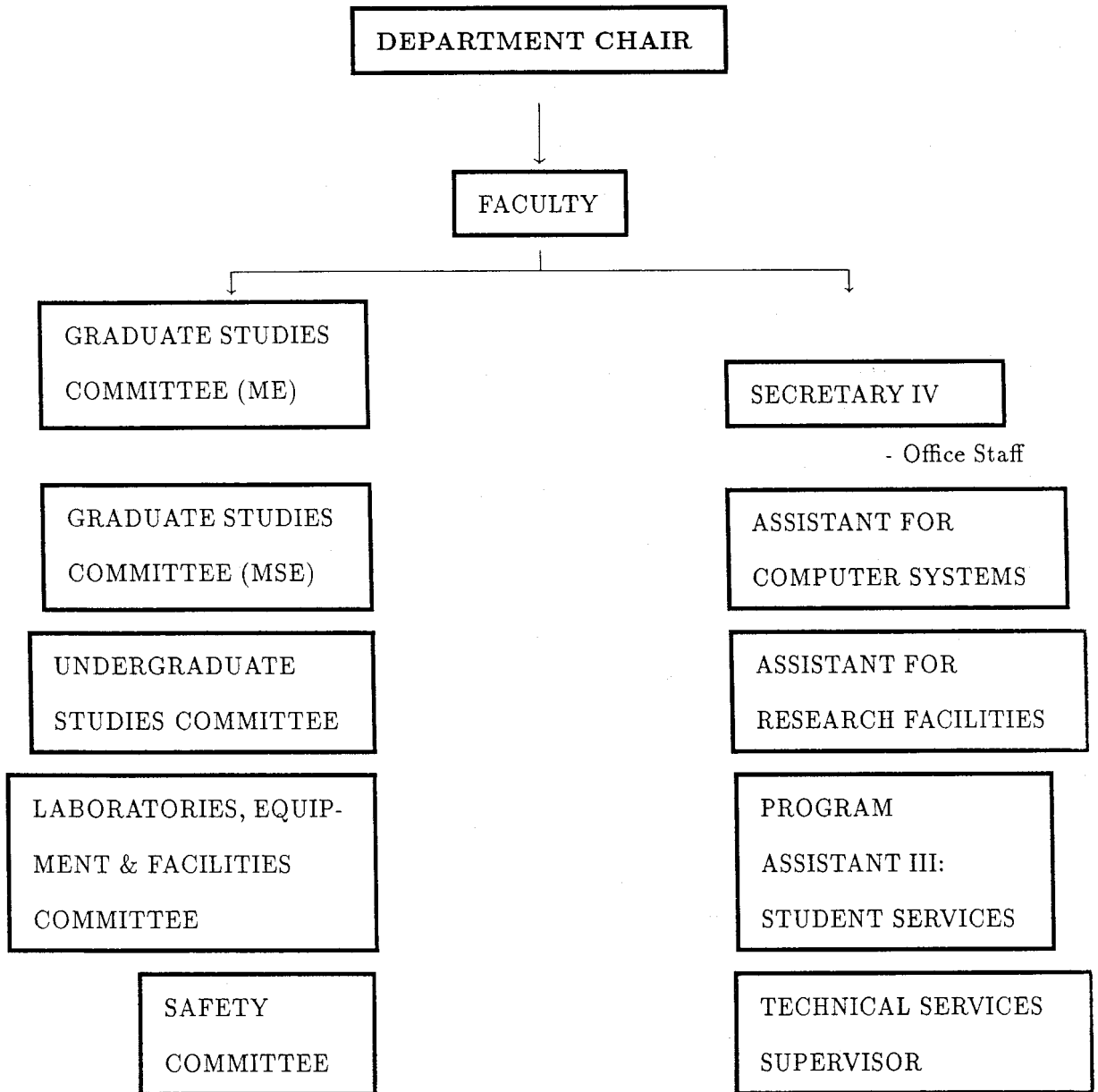
Appendix B: *TEX1* Output of Appendix A
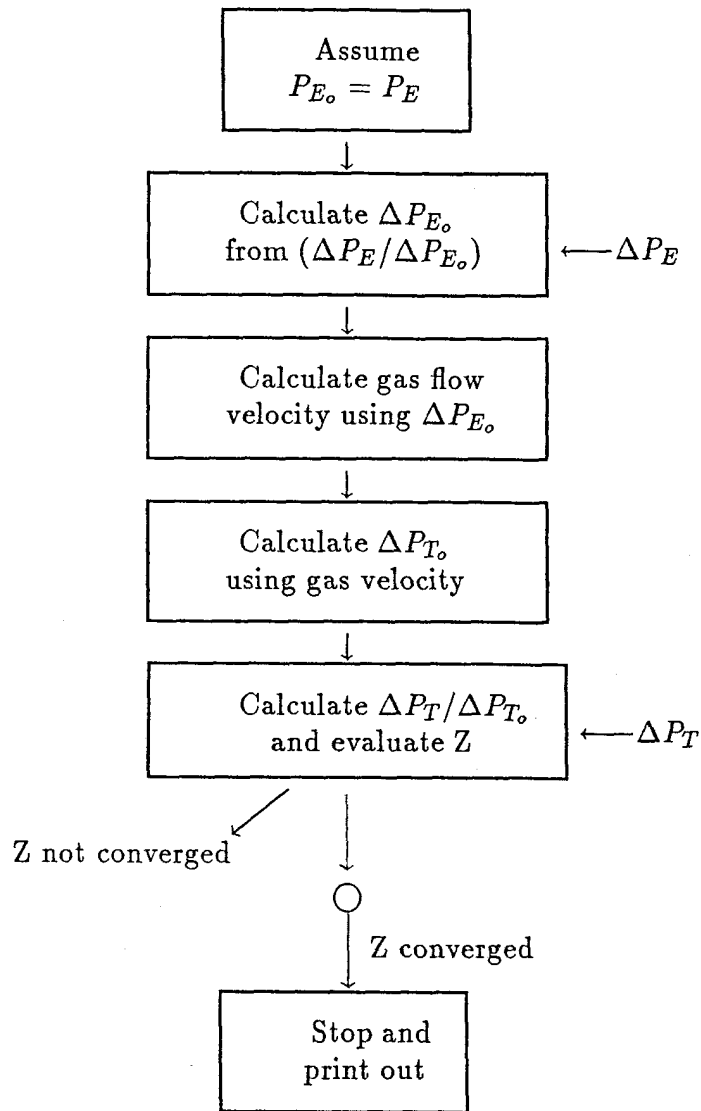
$$\boxed{\begin{array}{c} \text{Assume} \\ P_{E_o} = P_E \end{array}}$$

$\downarrow$

$$\boxed{\begin{array}{c} \text{Calculate } \Delta P_{E_o} \\ \text{from } (\Delta P_E / \Delta P_{E_o}) \end{array}} \longleftarrow \Delta P_E$$

$\downarrow$

$$\boxed{\begin{array}{c} \text{Calculate gas flow} \\ \text{velocity using } \Delta P_{E_o} \end{array}}$$

$\downarrow$

$$\boxed{\begin{array}{c} \text{Calculate } \Delta P_{T_o} \\ \text{using gas velocity} \end{array}}$$

$\downarrow$

$$\boxed{\begin{array}{c} \text{Calculate } \Delta P_T / \Delta P_{T_o} \\ \text{and evaluate Z} \end{array}} \longleftarrow \Delta P_T$$

Z not converged

$\bigcirc$

Z converged

$$\boxed{\begin{array}{c} \text{Stop and} \\ \text{print out} \end{array}}$$

```
                        ┌──────────┐
                        │ Develop  │
                        │ Target   │
                        │ Specs    │
                        └──────────┘
```

The Expanded Design Process - 11 Step.

	Months		
Activity	J F M A	M JU JL A	S O N D

ISC sub-project:

A. feature abstraction update

B. engagement abstraction update

C. run time environment design update

D. run time environment hardware and software update

E. control system design

F. implement control algorithm

G. ISC system testing

Process models sub-project:

H. process model development

I. mechanistic model parameter investigation

J. control/process model system simulation

Sensor sub-project:

K. design of AE fluid coupled sensor for CNC mill

L. fabrication of AE sensor

M. develop AE sensor monitoring environment for ISC

N. investigate AE signal for end mill surface generation

O. fabricate OM-2 force sensing system

P. calibrate and test force sensing system

OM-2 installation sub-project:

Q. complete mechanical and hydraulic installation

R. install contollers

S. initialize controller logic and test system

T. prepare final report

MECHANICAL & MATERIALS ENGINEERING
ORGANIZATIONAL CHART

| DEPARTMENT CHAIR |

| FACULTY |

| GRADUATE STUDIES COMMITTEE (ME) |

| SECRETARY IV |

- Office Staff

| GRADUATE STUDIES COMMITTEE (MSE) |

| ASSISTANT FOR COMPUTER SYSTEMS |

| UNDERGRADUATE STUDIES COMMITTEE |

| ASSISTANT FOR RESEARCH FACILITIES |

| LABORATORIES, EQUIP-MENT & FACILITIES COMMITTEE |

| PROGRAM ASSISTANT III: STUDENT SERVICES |

| SAFETY COMMITTEE |

| TECHNICAL SERVICES SUPERVISOR |

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Stanford University
Stanford, California
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