Computer-Aided Design and Parametric Design Instruction
In TAC/ABET Accredited Mechanical Engineering Technology Programs

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Abstract

This paper presents the results of a nationwide survey of Mechanical Engineering Technology (MET) programs concerning the implementation and preference of Computer-Aided Design (CAD) and "Parametric Design" software. Parametric Design software is defined as three-dimensional drawing software capable of changing the drawing if the dimensions are changed. This software also can realistically render the drawing or "model" and view the drawing in perspective as well as the orthographic views. The surveyed institutions were randomly chosen from TAC/ABET accredited programs. Twenty-four Mechanical Engineering Technology (MET) programs were surveyed by telephone. Nineteen programs were successfully contacted. However, in three days with five follow-up calls each, a knowledgeable faculty member could not be contacted in five programs. The results were that CAD software was being taught in all but one of the MET programs. This single program was a special case because it relied on a 2+2 program at a technical institute to provide CAD instruction. AUTOCAD was used more than any other software with 76% of the installations and CADKEY was next with 14%. AUTOCAD was rated 8.4 out of 10, a rather high satisfaction. The parametric design software packages in use were Mechanical Desktop, ProEngineer, with three programs each and one program using Prime Computer Vision. The total use of Parametric Design software was 7 or 37% of the total. Satisfaction with the Parametric Design software was very high at 9.1.

Introduction

Personal computer hardware has progressed to the point that expensive work stations are no longer required to run high-quality CAD software and even Parametric Design software. Parametric Design software is defined as three-dimensional drawing software capable of changing the drawing if the dimensions are changed. This software also can realistically render drawings or "models" and assemblies in perspective as well as the orthographic views. Industry job descriptions in engineering technology job advertisements indicate that facility with CAD software and often Parametric Design software are a prerequisite for entry level employment. The study found that CAD software is universally in use in MET programs and Parametric Design software use is growing. This paper presents the results of a nationwide survey of Mechanical Engineering Technology programs concerning the prevalence and satisfaction with CAD and parametric design software.

The Survey

From a list of the 54 MET programs accredited by TAC/ABET, 24 were randomly selected. Attempts were made over a 3-day period to contact knowledgeable personnel at these programs. Follow-up calls were made if necessary. An appropriate faculty member was contacted in 19 of the selected 24 programs or 79%. The sample size and contact rate of 79% is sufficiently high to infer that the characteristics contained in the sample are valid for MET programs overall. One faculty member in the School of Engineering Technology at the University of Southern Mississippi conducted the survey.

The Questionnaire

A standard telephone procedure was used to assure that the correct person was reached, and a structured interview was followed so that the questions were asked identically. The following are the results of the questionnaire. Voluntary comments are included where appropriate. A response of ? indicates that the respondent did not say their level of software satisfaction.

Are you teaching computer-aided design?
Y = 18
N = 1 (One upper division MET program with CAD taught at a 2-year technical institute)

What software are you using?
AutoCAD R10  2  (No funds for upgrades)
AutoCAD R12+AME  5  (Problems with R13 caused some to stay with R12)
AutoCAD R13  6
AutoCAD R14  2
CADKEY  2 (Because the cost is low or free)
ProEngineer  1
Microstation Intergaph  1
AutoCAD Light  1
Note: Some programs were using two software packages.
What is your satisfaction level with your CAD software?

<table>
<thead>
<tr>
<th>Software</th>
<th>Ratings</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoCAD R10</td>
<td>6</td>
<td>= 6</td>
</tr>
<tr>
<td>(Used with AutoCAD Light)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AutoCAD R12</td>
<td>6, 9, 9, 9, 9, 9 =</td>
<td>8.5</td>
</tr>
<tr>
<td>AutoCAD R13</td>
<td>9, 9, ? 9, 9, 9 =</td>
<td>9</td>
</tr>
<tr>
<td>AutoCAD R14</td>
<td>9, 8</td>
<td>= 8.5</td>
</tr>
<tr>
<td>CADKEY</td>
<td>9, 8</td>
<td>= 8.5</td>
</tr>
<tr>
<td>Microstation Intergraph</td>
<td>10</td>
<td>= 10</td>
</tr>
<tr>
<td>AutoCAD Light</td>
<td>8</td>
<td>= 10</td>
</tr>
</tbody>
</table>

(Low price to students)

If you are unsatisfied, what would you change to?
1. Two programs would like to change from AutoCAD R12 to CADKEY because it is cheaper. However, the nearby market was AutoCAD oriented and they must use the older AutoCAD R12.
2. One program would change from AutoCAD R12+AME to AutoCAD R14 but no funds are available.
3. One program would change from AutoCAD R13 to AutoCAD R14 but no funds are available.
Note: Five users of AutoCAD R13 were satisfied and not planning soon to upgrade to AutoCAD R14.

Are you teaching three-dimensional CAD?
Y = 13
N = 4 One with AutoCAD R12 only; One with slow hardware.

Are you teaching Parametric Design?
Y = 7
N = 11

If so, what software are you using?
- Mechanical Desktop 3
- Prime Computer Vision 1
- ProEngineer 3

What is your satisfaction level with your Parametric Design software? 1-10.

<table>
<thead>
<tr>
<th>Software</th>
<th>Ratings</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Desktop</td>
<td>10, 9, ?</td>
<td>= 9.5</td>
</tr>
<tr>
<td>Prime Computer Vision</td>
<td>9</td>
<td>= 9</td>
</tr>
<tr>
<td>ProEngineer</td>
<td>9, 9, 8</td>
<td>= 8.7</td>
</tr>
</tbody>
</table>

If unsatisfied, what would you change to?
One program would change from ProEngineer to Mechanical Desktop.

Discussion

CAD Software: Several institutions used more than one software package so that the total counted software exceeded the number of institutions. The survey revealed that eight software packages were in use and five of them were types of AutoCAD. The most widely used software package was AutoCAD R13 which comprised 6 installations or 32% of the total software installations. All of the AutoCAD products comprised 16 or 84% of the total software installations. The next most widely used software package was CADKEY with 2 or 11% of the total installations. The remaining software, ProEngineer (used also for CAD) and Microstation Intergraph were used only at one program each. The overall level of CAD software satisfaction was 8.7 which was quite high. Only the older AutoCAD R12 was not highly rated.

Parametric Design Software: Mechanical Desktop and ProEngineer were both in equal use with three programs each. One program used Prime Computer Vision. The total use of Parametric Design software was 7 or 37% of the total. In a study done by the author in 1989, no Parametric Design software was in use in MET programs although it was in use on expensive workstations in industry. [1] Thus, a trend of increased usage appears to have been indicated by these two studies. Satisfaction with all of the Parametric Design software was very high at 9.1.

References:

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