Perspective and New Trend of Civil Engineering Education in Japan

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In Japan, all universities have changed their research and education systems due to the public requirements of accountability, disclosure and efficiency. Especially, the education system should be evaluated by a third party. This tendency has been accelerated after the privatization of national universities.

In order to evaluate the engineering education system fairly, the Japan Accreditation Board for Engineering Education (JABEE) has been established in 1999. The other trend of new engineering education is to develop an e-learning system and its application. In this paper, the two topics of the new accreditation system and application of e-learning for engineering education in Japan are introduced.
Summary (2)

- The other trend of engineering education is an introduction of e-learning. In Japanese many universities, attempts have been made to develop various e-learning systems for English education, IT technology education and other educations. However, no e-learning system for civil engineering education has been yet established in Japan. Here, a prototype of e-learning system developed in Kansai University is described, which is used for the education of engineering mathematics.
JABEE means the Japan Accreditation Board for Engineering Education that is an independent organization that oversees the delegation of member societies in specific academic and engineering disciplines. According to the website of JABEE, its aim is to ensure the international equivalency of engineering education programs to develop engineers provided by Japanese institutions of higher education, such as universities, and to contribute to the development of society and industry through the promotion of engineering education and the training of international engineers, by collaborating with academe and industry respectively, and by accreditation under standardized criteria.
Activities of JABEE (1)

- (1) Establishing accreditation criteria and procedures, conducting examinations and accreditations, and publicizing the accreditation of engineering education programs provided by institutions of higher education
- (2) Training Examiners to examine engineering education programs
- (3) Designating, administering, and coordinating partner organizations from the field of accreditation to examine engineering education programs
- (4) Conducting surveys and issuing proposals about the examination and accreditation of engineering education programs
(5) Coordinating collaboration with academe and industry respectively in the accreditation and examination of engineering education programs
(6) Promoting understanding of the examination and accreditation of engineering education programs
(7) Enhancing international mutual recognition of and information exchange in the examination and accreditation of engineering education programs
(8) Other activities necessary for achieving the purposes of JABEE
Civil engineering programs leading to bachelor’s degree accredited by JABEE during 2001 to 2005 are listed below:

1) Akita University (National)
2) Ashikaga Institute of Technology
3) Ehime University (National)
4) Gifu University (National)
5) Gunma University (National)
6) Hachinohe Institute of Technology
7) Hiroshima University (National)
8) Hokkaido University (National)
9) Hokkai-Gakuen University
10) Hosei University
11) Kagoshima University (National)
12) Kanazawa Institute of Technology
13) Kanazawa University (National)
14) Kansai University
15) Kinki University
16) Kitami Institute of Technology (National)
17) Kochi National College of Technology
18) Kumamoto University (National)
19) Kure National College of Technology
20) Meijo University
21) Muroran Institute of Technology (National)
22) Musashi Institute of Technology
23) Nagaoka University of Technology (National)
24) Nagoya University (National)
25) Nihon University
26) Osaka City University
27) Osaka Institute of Technology
28) Ritsumeikan University
29) Saitama University (National)
30) Takamatsu National College of Technology
31) The University of Tokushima (National)
32) Tokyo Denki University
33) Tokyo Institute of Technology (National)
34) Tottori University (National)
35) Toyohashi University of Technology (National)
The number of national and public universities is 27, whereas the number of private universities is 13. Thus, the total number is 40. Note that two big influential universities, The University of Tokyo and Kyoto University, are not involved in the list.
Recently, practical use of e-learning as a teaching material is increasing through the expansion of network technology by which various study contents are eminently accessible for learning. Offerings via the internet for e-learning are particularly called Web-Based Training (WBT). Originally used for education in companies, it is increasingly used for correspondence courses for acquisition of linguistic and professional qualifications. Furthermore, graduate schools have been established that offer all subjects exclusively through e-learning. Preliminary government initiatives to use e-learning are being prepared. Practical use as accessory teaching materials is also expected in primary and secondary school education. Such demands require the research and development of e-learning systems and production of teaching materials that are easy to use and can thereby allow efficient study.
Contents (1)

- Differential (basic course)
  1) Differential coefficient
  2) Derived function
  3) Calculation of derived function
  4) Various examples of differential (1)
  5) Primitive function
  6) Summary
Contents (2)

- Differential (advantage course)
  1) Increase and decrease of a function
  2) Maximal and minimal of a function
  3) Maximum and minimum of a function
  4) Various examples of differential (2)
  5) Summary
Contents (3)

Integral
1) Function and definite integral
2) Definite integral and primitive function
   (Indefinite integral)
3) Calculation of integral
4) Various example of integral
5) Summary
関数 $f(x) = x^2$ で表される坂道において、基準点$O$から水平距離1$m$の坂道上の地点を点$P$とする。

点$P$の基準点$O$からの高度差は $f(x) = x^2$ である。つまり、点$P$は座標$(1,1)$で表される。

点$P$から更に水平距離で $h$ m 登った地点を点$Q$とすると、点$Q$の$x$座標は $1+h$。

よって、点$Q$の基準点$O$からの高度差は $(1+h)^2$ m である。

従って、基準点$O$から水平距離1$m$の地点から、水平距離で $h$ m だけ登る。

この間に登った高さは、$f(x) = x^2$ とすると、

\[ f(1+h) - f(1) = (1+h)^2 - 1^2 \]
\[ = 1 + 2h + h^2 \]
\[ = 2h + h^2 \] ... (1)

である。

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**Differential Coefficient**

**問題**

関数 \( y = x^2 \) で表される坂道と、その上の地点 \( P(1,1) \) がある。点 \( P(1,1) \) における坂道の傾きを求める式はどれか。

A. \( \lim_{h \to 1} \frac{(1+h)^2 - 1^2}{h} \)

B. \( \lim_{h \to 0} \frac{(1+h)^2 - 1^2}{h^2} \)

C. \( \lim_{h \to 0} \frac{(1+h)^2 - 1^2}{h} \)

**A B C**
ボールの投げ上げ

ゲストさん、こんにちは。

知っておきたい微分積分
《入門編》

TOP > 総合目次 > 微分のいろいろな例(1) > 目次 > ボールの投げ上げ

ボールを地上から速度49 m/秒で真上に投げ上げたとき、投げ上げてから1秒後におけるボールの高さ$s(m)$は、

したがって$s=49 t - 4.9 t^2$ (m)・(1)

で表されることが知られている。1秒後のボールの速度$v$は、$v-f(t)$の導関数であるので

$v=-98 t+49$ (m/秒) ・・(2)

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関数のグラフの概形 - Lesson1 - 知っておきたい微分積分 - Microsoft Internet Explorer

関数のグラフの概形 - Lesson1

関数 $y=f(x)$ の増減のようすを調べ、グラフの概形をかいてみよう。
例：関数 $y=x^3-3x^2+2$ のグラフの概形をかいてみよう。

増減表

<table>
<thead>
<tr>
<th>$x$</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>+</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

関数 $y=x^3-3x^2+2$

$f(x)=0$ となるのは、$f(x)=(x-1)(x^2-2x-2)$

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Increase and Decrease of a Function

問題

関数$f(x) = x^2 - 9$のグラフの概形はどれか？
Maximum and Minimum of a Function

Maximum and Minimum of a Function

次関数の最大値と最小値を求めよう。

\[ f(x) = 2x^3 - 3x^2 - 12x \quad (-2 \leq x \leq 4) \quad \cdots (1) \]

\[ f'(x) = 6x^2 - 6x - 12 \]
\[ = 6(x+1)(x-2) \quad \cdots (2) \]

\[ f'(x) = 0 \]とすると

\[ x = -1, 2 \]

よって、\( f(x) \)の増減表は次のようになる。

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f'(x) )</td>
<td>+</td>
<td>0</td>
<td>-0</td>
<td>+</td>
</tr>
<tr>
<td>( f(x) )</td>
<td>-4</td>
<td>7</td>
<td>-20</td>
<td>32</td>
</tr>
</tbody>
</table>

ゆえに、\( x = 4 \)で最大値32、\( x = 2 \)で最小値-20をとる。

上の例だからもわかるように、極大値、極小値は必ずしも最大値、最小値ではない。一般に、区間\( a \leq x \leq b \)で定義された関数の最大値、最小値は、この区間での関数の極値と区間の両端での関数の値を比べて、求めることができる。
Definite Integral

\[ \int_a^b x \, dx \]

If \( f(x) = x \) then, roughly
\[ \int_a^b x \, dx \] to consider.

\( x_i = a + \frac{b-a}{n} \)
\( x_i = a + \frac{b-a}{n} \quad \cdots \quad (1) \)
\( M_i = a + \frac{b-a}{n} \cdot (i - 1) \)
\( M_i = a + \frac{b-a}{n} \cdot i \quad \cdots \quad (2) \)
Various Example of Integral

1] $a \leq x \leq b$における曲線$y=f(x)$と$x$軸との間の面積を求めることを考えよう。

$f(x)$の定積分 $\int f(x) \, dx$ と異なるのは、水の流入で話すると、流出のところ($f(x)<0$)でも+でカウントしなければならないことがある。つまり$f(x)$を積分しなければならない。

\[ \int |f(x)| \, dx \quad ... (1) \]

例えば、図の様な場合$c \leq x \leq d$では、$f(x)$の加わりに、$|f(x)|=-f(x)$としなければならない。よって
Experiment

- Contents
  320 pages (Lessons and Questions)

- Experiment term
  October, 2004 – January, 2005

- Subject
  96 students
  Faculty of Informatics, Law, Letters
Faculty of Students

- Informatics: 70%
- Law: 20%
- Letters: 4%
- Others: 6%
Completion Status in High School

Math 1: 100%
Math 2: 100%
Math 3: 60%
Math A: 100%
Math B: 100%
Math C: 60%
Results of Examination and PageView

Results of Examination

PageView
In Japan, all universities have changed their research and education systems due to the public requirements of accountability, disclosure and efficiency. In this paper, attempts of Japanese universities were introduced, which are directed to change themselves to more open and efficient universities. JABEE was founded in November 19, 1999 with the aim of ensuring, by collaborating with academe and industry respectively, and by accreditation under standardized criteria, the international equivalency of engineering education programs to develop engineers provided by Japanese institutions of higher education, such as universities, and contributing to the development of society and industry through the promotion of engineering education and the training of international engineers. As indicated in this paper, more than half universities in Japan have already been accredited for civil engineering education programs by JABEE.
Conclusions (2)

- It is evident that the introduction of the accreditation system for engineering programs induces the improvement of the quality of engineering educations. However, it requires a lot of efforts to maintain the continuous support of the accreditation system. At present it is difficult to evaluate whether the introduction of the accreditation system is successful or not. It will be made clear that the accreditation system is truly necessary and useful to keep the quality of engineering education high.
Conclusions (3)

- It became possible to pursue learning behavior and student management using detailed teaching materials page browsing records obtained from the access log of this system. The obtained study history data is important information to determine the relation between a learning process and the degree of acquisition. Applying data mining techniques using rough sets and genetic algorithms for study history data suggested a learning pattern for each student. Using derived knowledge for educational guidance of a student, a WBT system that treats many students simultaneously can offer good educational value.