

Scientific Workaholic

— *Work Scientifically and Have Fun*

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Yingcai 2009, UESTC

Dec 6th, 2011

Working on Science with Modern Computer Technology

Working on science in a digital era with the aid of:

- *Internet*
- *Linux*
- *L^AT_EX*
- *Python*

Working on Science with Modern Computer Technology

Working with the *Internet*.

- Obtaining knowledge online via *Wikipedia*, *OpenCourse*, *Wolfram Alpha* etc.
- Accessing your files while keeping the track of modifications by using a *Cloud Storage Service*.

Working on Science with Modern Computer Technology

Working with *Linux*.

- Learn to use *Linux* by using it.
- Setting up a personal workspace by *hacking* on *Linux*.
- Diving into the gold mine of *Open Source Community* and try to be part of it!

Working on Science with Modern Computer Technology

Working with \LaTeX

\LaTeX is a document preparation system designed for high quality typesetting, especially for *scientific documents*.

- Beautiful math formula.

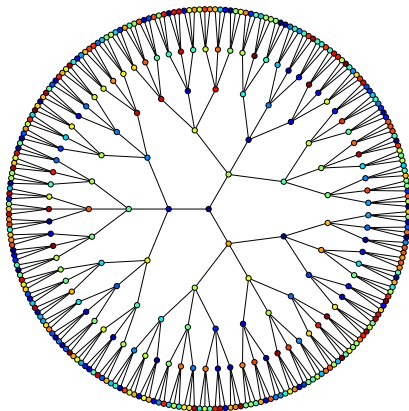
$$i\hbar \int_{-\infty}^t \frac{\partial^2 \Psi}{\partial \tau^2} d\tau = -\frac{\hbar^2}{2m} \frac{\partial^2 \Psi}{\partial x^2} + V\Psi$$

- Professional typesetting with academic style.
- Highly customizable and functional: *even this slide is made by \LaTeX Beamer!*

Working on Science with Modern Computer Technology

Working with *Python*.

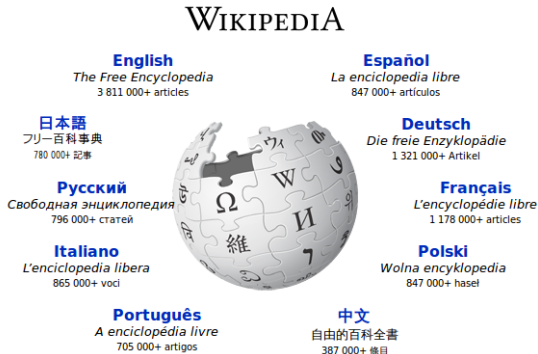
- Programming with *Python* – *Executable Pseudo-code*.
- Scientific computation and visualization with *NumPy*, *SciPy*, *Matplotlib*, *IPython* etc.



Learning Science via Wikipedia

Wikipedia is a free, web-based, collaborative, multilingual encyclopedia project supported by the non-profit Wikimedia Foundation.

Wikipedia was launched in January 2001 by *Jimmy Wales* and *Larry Sanger*.



Learning Science via OpenCourse Projects

The screenshot shows the MIT OpenCourseWare (OCW) website. At the top, the header includes the MIT logo, the text "MIT OPEN COURSEWARE" and "MASSACHUSETTS INSTITUTE OF TECHNOLOGY", and a "SIGN UP FOR OCW NEWS" button. Below the header is a navigation bar with links: Home, Courses, Donate, About OCW, Help, and Contact Us. A search bar is also present. The main content area features a sidebar on the left with links like "Get Started with OCW", "VIEW ALL 2000 COURSES", and "Find Courses". The central part of the page has a large banner with the text "Unlocking Knowledge, Empowering Minds." and "Free lecture notes, exams, and videos from MIT. No registration required." Below this banner is a blue bar with the text "Open Yale courses". At the bottom, there is a navigation bar with links: Home, Courses, About, Terms of Use, Feedback, and Help.

MIT

Yale

Learning Science via OpenCourse Projects

VeryCD、网易视频...

公开课
热门推荐

推荐

欧美

内地

 <p>《幸福课》 Tal Ben-Shahar</p>	 <p>《TED演讲》 Yves Behar / Alwar</p>	 <p>《欧洲文明》 John Merriman</p>	 <p>《旧约全书导论》 Christine Hayes</p>	 <p>《公正》 Michael J. Sandel</p>
 <p>《土豆公开课》 方舟子</p>	 <p>《新媒体时代的...》 Anne Whiston Spirn</p>	 <p>《振动与波》 Walter Lewin</p>	 <p>《法学讲座》 多人</p>	 <p>《透过摄影感受...》 Anne Whiston Spirn</p>

Doing Math via Wolfram Alpha

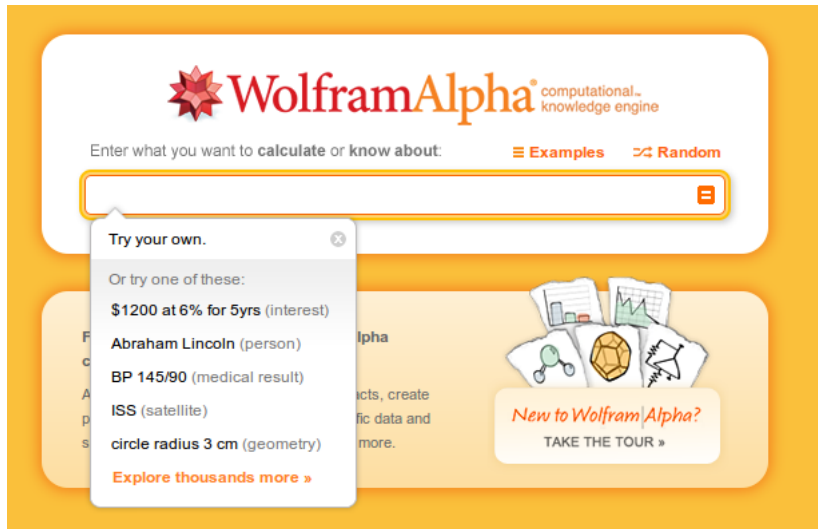
Stephen Wolfram is a British scientist and the chief designer of the **Mathematica** software application and the **Wolfram Alpha** computational knowledge engine.



Mathematica

Doing Math via Wolfram Alpha

www.wolframalpha.com



The image shows the Wolfram Alpha homepage with an orange background. At the top is the Wolfram Alpha logo, which includes a red 3D star icon and the text "WolframAlpha" in a serif font, with "computational knowledge engine" in a smaller sans-serif font to the right. Below the logo is a search bar with the placeholder text "Enter what you want to calculate or know about:". To the right of the search bar are two links: "Examples" and "Random". Below the search bar is a dropdown menu with the title "Try your own." and a close button (an 'x' in a circle). The dropdown lists several suggestions: "Or try one of these:", "\$1200 at 6% for 5yrs (interest)", "Abraham Lincoln (person)", "BP 145/90 (medical result)", "ISS (satellite)", "circle radius 3 cm (geometry)", and "Explore thousands more »". To the right of the dropdown is a section titled "New to Wolfram Alpha?" with a button that says "TAKE THE TOUR »". Above this button are four small icons: a bar chart, a line graph, a 3D cube, and a sine wave.

WolframAlpha computational knowledge engine

Enter what you want to calculate or know about: [Examples](#) [Random](#)

Try your own. ×

Or try one of these:

- \$1200 at 6% for 5yrs (interest)
- Abraham Lincoln (person)
- BP 145/90 (medical result)
- ISS (satellite)
- circle radius 3 cm (geometry)
- [Explore thousands more »](#)

New to Wolfram Alpha? [TAKE THE TOUR »](#)

Doing Math via Wolfram Alpha



$\sin(x)^2 \cos(2x)$

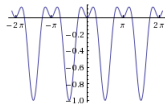


Examples Random

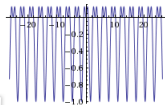
Input:

$\sin^2(x) \cos(2x)$

Plots:



(x from -6 to 6)



(x from -20 to 20)

Alternate forms:

$$\frac{1}{4} (2 \cos(2x) - \cos(4x) - 1)$$

More



UESTC



Examples Random

Input interpretation:

Dianzi Keji Daxue

Basic information:

name	Dianzi Keji Daxue
location	Chengdu, Sichuan, China (population: 11.4 million)
website	www.uestc.edu.cn

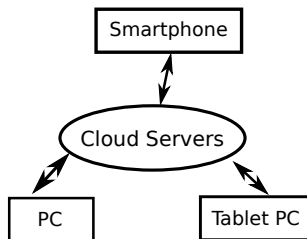
Location:



Satellite image »

Using a Cloud Storage Service

What is a *cloud storage service*?



Why should I use it?

- **Synchronizing** my files on all my devices, including laptop, PC, tablet, phone etc.
- A simple **CVS** (*Concurrent Versions System*) for monitoring modifications.
- **Sharing** my files easily.
- **Free** for average users.

Using a Cloud Storage Service

Good services:



(Blocked by GFW)



Moving from Microsoft Windows to GNU Linux

Linux is a Unix-like computer operating system assembled under the model of free and open source software development and distribution.



The defining component of any Linux system is the **Linux kernel**, an operating system kernel first released October 5, 1991 by **Linus Torvalds**.



Linux Distributions

Linux system *distributions* may vary in many details of system operation, configuration, and software package selections.

The logo for Fedora Linux, featuring the word "fedora" in a blue sans-serif font, with a small blue circle containing a white lowercase "f" to its upper right.The logo for Debian Linux, consisting of a red swirl icon above the word "debian" in a black sans-serif font.The logo for Ubuntu Linux, featuring the word "ubuntu" in a black sans-serif font, with a small orange circle containing a white lowercase "u" to its upper right.The logo for Linux Mint, featuring a green square icon with a white "LM" inside, followed by the text "Linux Mint" in a green sans-serif font, and the tagline "from freedom came elegance" in a smaller black font below it.The logo for SUSE Linux, featuring a green lizard icon above the word "suse" in a green sans-serif font.

I'm using Ubuntu Linux 10.10 Maverick Meerkat.

What can I do with Linux?

Is there anything that I can do with Windows but not Linux?

Answer: Yes, there is. But that's generally *not worth doing*.

What can I do with Linux?

Answer:

- Working with incredibly *high efficiency*, which can never be expected on Windows.
- A perfect environment for learning *programming*.
- Enjoying countless *free and open-source* softwares.
- Making it your personal workspace by customizing and even *hacking* it!

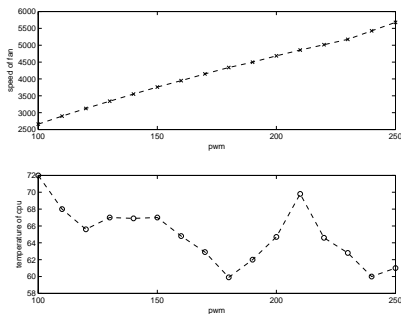
Hacking for Fun!

My projects

- A *fan speed controller* for my ThinkPad SL400 laptop

How did I work it out?

- The interface on Linux for controlling the speed of fan.
- The relation between temperature, fan voltage and fan speed.

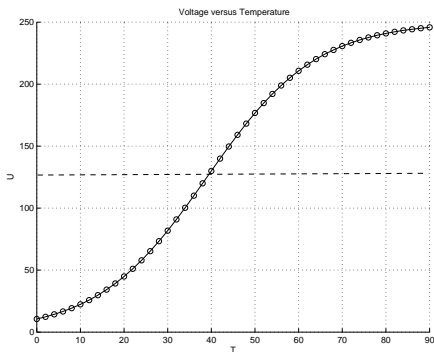


Hacking for fun!

- Adaptive control for fan speed by automatically adjusting fan voltage according to the temperature.

Logistic Function

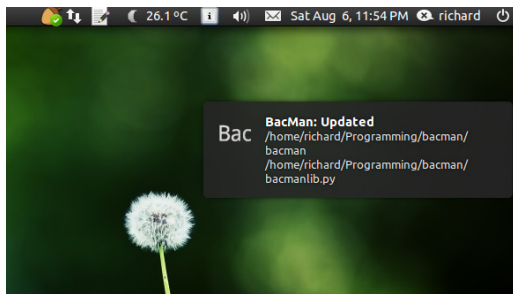
$$U = \frac{kP_0 e^{r(T-T_0)}}{k + P_0(e^{r(T-T_0)} - 1)}$$



Hacking for fun!

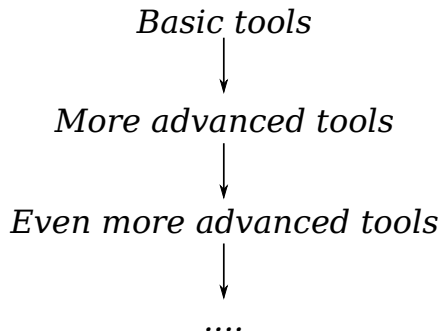
Another project — *BacMan* for backing-up and synchronizing my files distributed anywhere on my computer.

- Synchronize local files to cloud directory every 10 minutes when modification occurred.
- Synchronize cloud directory files to my local directories when needed.
- High efficiency thanks to *rsync* differentiation and synchronization program on Linux.



The Joy and the Philosophy of Tools

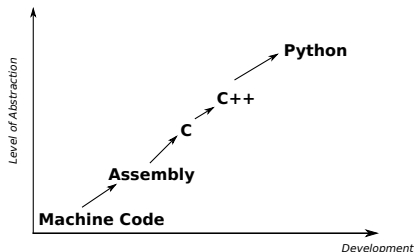
The simple philosophy behind tools:



The Joy and the Philosophy of Tools

This general rule can be reflected in the process of human progress in science and technology.

And in the perspective of computer programming



Implications

- Use advanced tools for higher efficiency.
(*higher level of abstraction may also mean slower execution though*)
- Create your own tools and try to make them open-source!

Elegant Typesetting with L^AT_EX

A glorious endeavour all started with *Donald Knuth* and his *The Art of Computer Programming*.

Donald Knuth

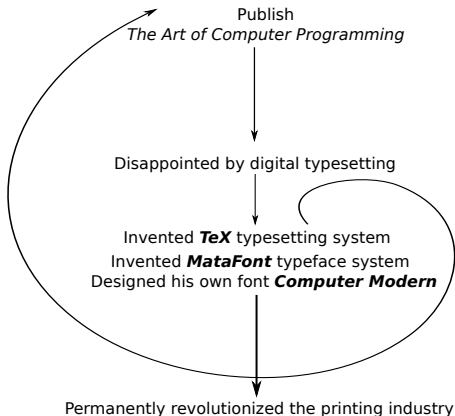


Computer scientist and Professor Emeritus at Stanford University, the *father* of the analysis of algorithms, the author of *The Art of Computer Programming*, and T_EX typesetting system.

Elegant Typesetting with L^AT_EX

The disappointing galley proofs of *The Art of Computer Programming II* gave him the final motivation to solve the problem at hand once and for all by designing his own typesetting system.

On May 13, 1977, he wrote a memo to himself describing the basic features of T_EX.



Elegant Typesetting with L^AT_EX

L^AT_EX is a document markup language and document preparation system for the T_EX typesetting program, developed by **Leslie Lamport**.

Features of L^AT_EX

- Writing documents by markup language instead of the “WYSIWYG” style of *Microsoft Word*.
- Concentration on writing while let most of the typesetting and layout jobs automatically done by the system, on condition that the document is *well-structured*.

- Powerful and beautiful mathematical formula.

When we write $A = \int_{-\infty}^{+\infty} \frac{\cos^2 \theta}{2n^2 \theta^2}$ outside, we have

$$A = \int_{-\infty}^{+\infty} \frac{\cos^2 \theta}{2n^2 \theta^2}$$

Start from a minimal L^AT_EX example

Tips:

- Use a good text editor for writing in L^AT_EX. (*I use gedit on Linux.*)
- Learn by using.
- Use XeLaTeX for writing in 中文 and other languages, where *Unicode* is supported.
- Explore macro-packages and define your own macro-commands.
- Start from basic mathematical typesetting.

Embrace Python — a promising new language

Python is a general-purpose, high-level programming language whose design philosophy emphasizes code readability.

Python claims to “remarkable power with very clear syntax”, and its standard library is large and comprehensive. Its use of *indentation* for block delimiters is unique among popular programming languages.



Scientific Computation with Python-based tools

Toolset



NumPy



SciPy.org



Sponsored by
ENTHOUGHT



matplotlib

IP[y]: IPython
Interactive Computing

Why use them?

- Free and open source, while *MATLAB* and *Mathematica* are proprietary and expensive.
- Easy scripting with *Python*.
- Compatible with other packages for integration towards a systematic computational platform.

Thanks!

*Contact me via
richardkwo@gmail.com*