# 开设和实施MOOC过程中的一些体会

清华大学 电路原理 课程负责人
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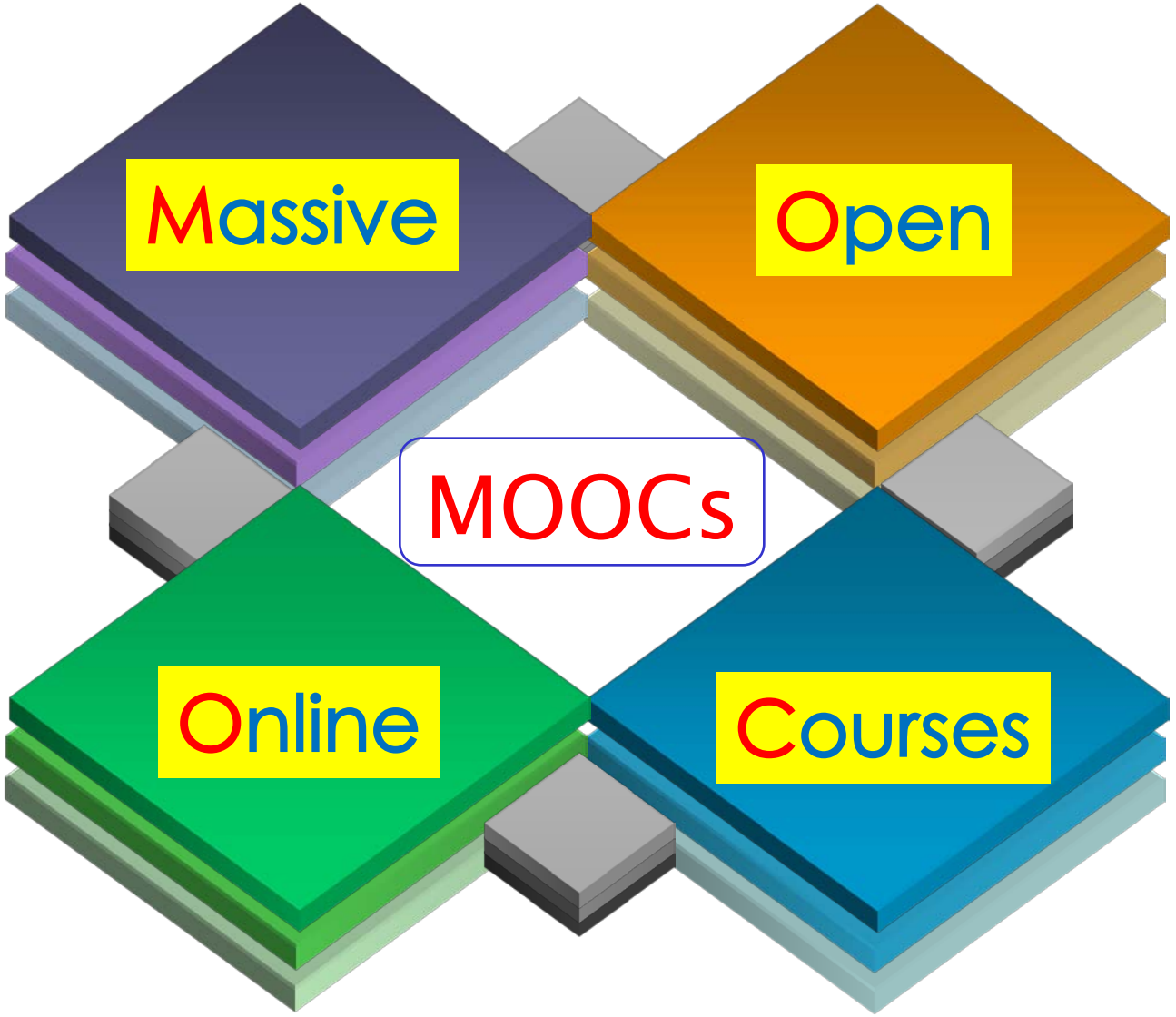
# 纲要

- 什么是MOOCs
- 清华大学电路原理的MOOC
- 怎么制作MOOC
  - 分合之道
- 怎么利用MOOC（略）
  - 落地之道

# MOOCs



# MOOCs三大阵营

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A fun and interactive course designed to help you explore the edX learning experience. Perfect to take before you start your course. MORE
STARTS: n/a self-paced • INSTRUCTORS: Brown, Donald, Fisc... • edX
learn more

NEW CS1156x: Learning From Data
Introductory Machine Learning course covering theory, algorithms and applications.

# 我们正激流勇进


- 综合平台
  - 中国大学MOOC（爱课程）
  - 学堂在线（清华）
  - 好大学在线（中国高水平大学MOOC联盟）
  - 育网（五所交大）
- 专业平台/联盟
  - 林业、医学
- 区域平台/联盟
  - 东西部高校课程共享联盟(北京大学)、智慧树(上海高校课程中心)、优客联盟(深圳大学)
- 商业公司
  - 网易、超星、过来人……

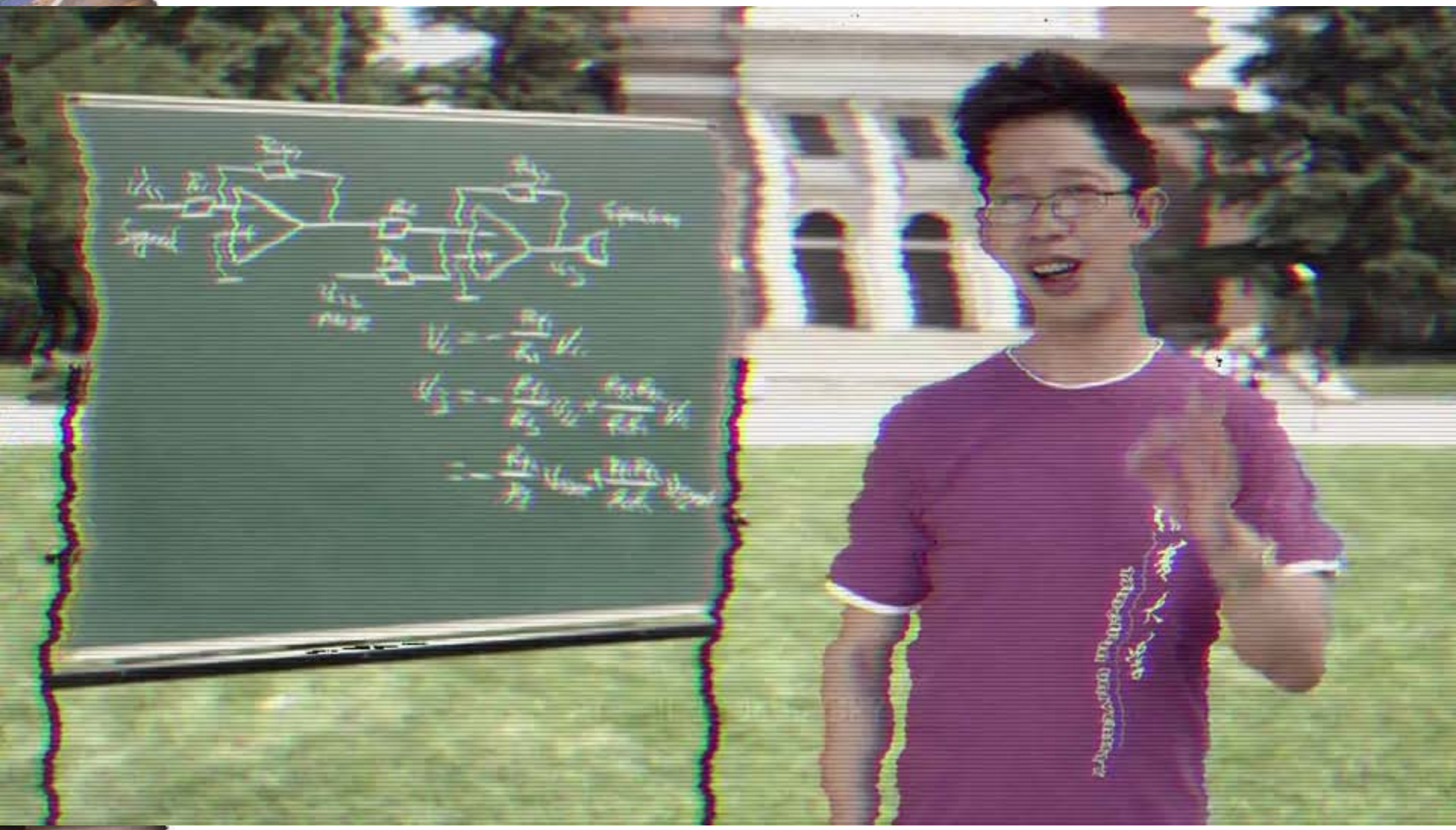
# 诞生MOOCs的三大原因

- “价格便宜量又足”的高等教育
- 互联网、人工智能、大数据……
- 顶级学校在教育和人才领域的竞争

# 我为什么要做电路MOOC

- 建设世界一流大学的需求
- 提高清华自身人才培养质量的需求
- 提高普通高校教学质量的需求

# 清华电路原理的MOOC授课



# 清华电路原理课程的两个平台

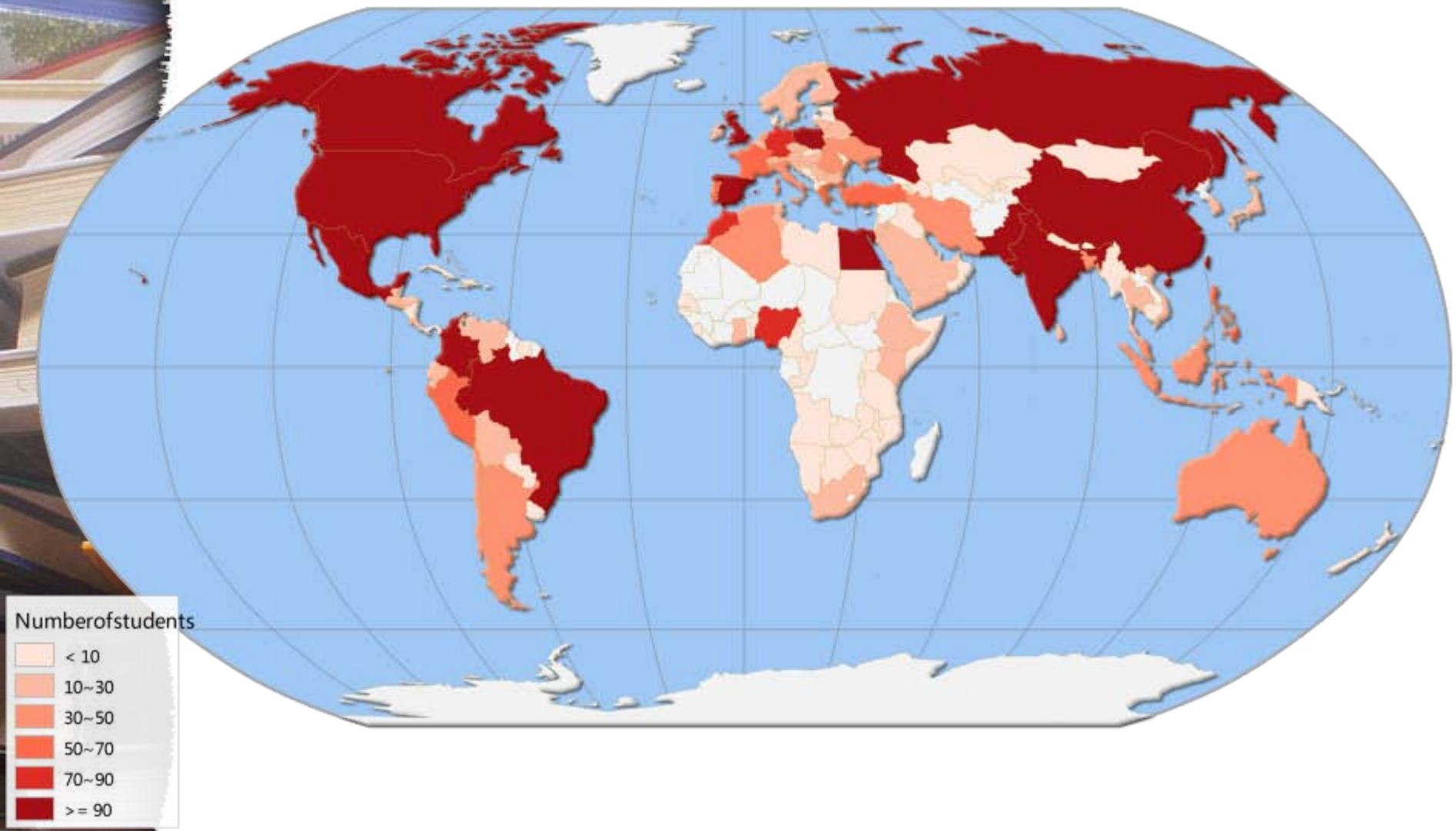
- edX
  - 面向国际
  - http://www.edx.org
- 学堂在线
  - 面向国内
  - http://www.xuetangx.com

# 清华电路原理MOOC的注册人数

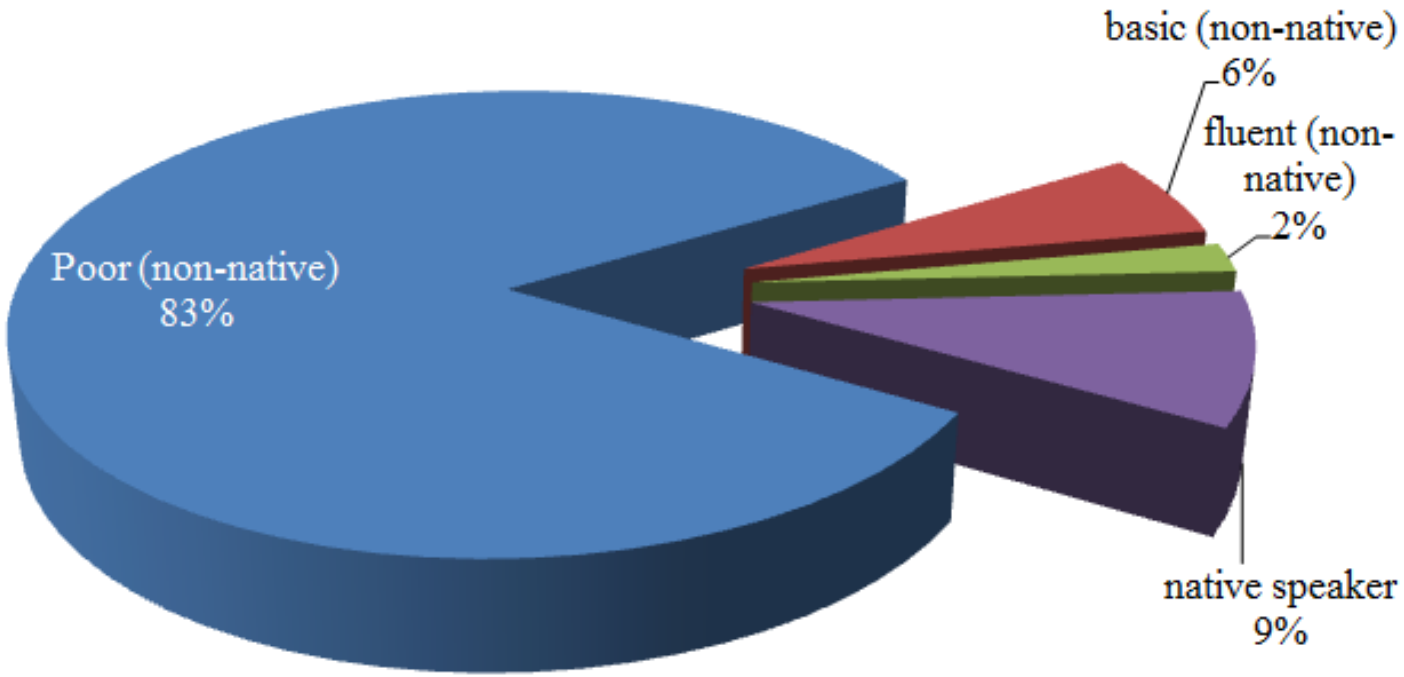
- 第1部分 (week 1-8)
  - edX：>11800
  - 学堂在线：>11700
  - Total：>23000
- 第2部分 (week 9-16)
  - edX：>4600
  - 学堂在线：>3700
  - Total：>8000

# 第1部分学生分布

Geographical distribution of students for course 20220332X

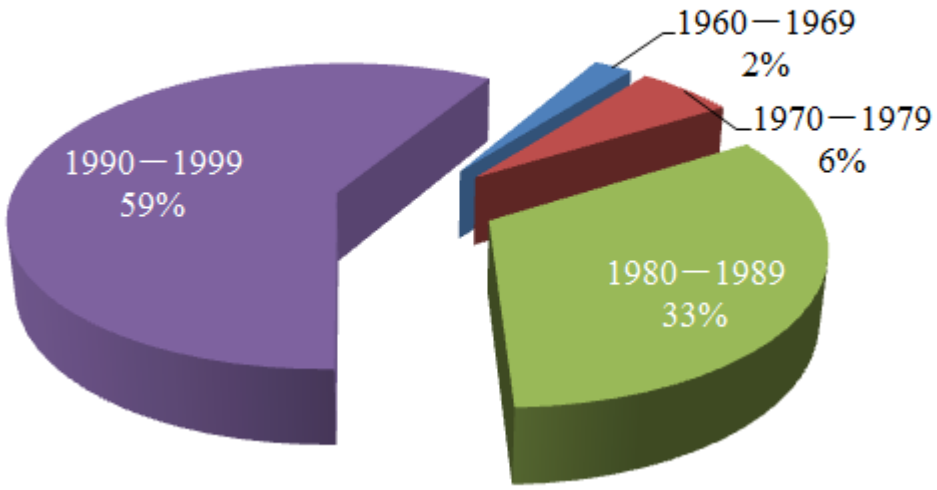


# 第1部分edX平台中文水平分布

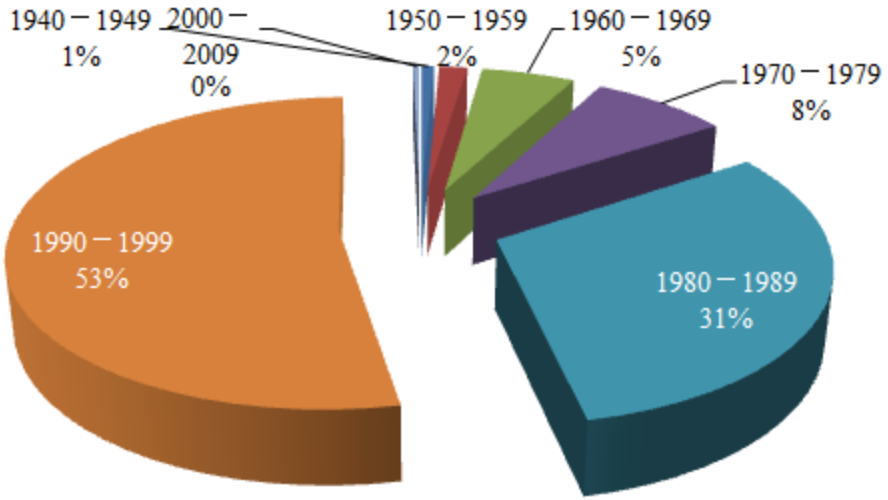


# 第1部分学生出生年份分布

学堂在线

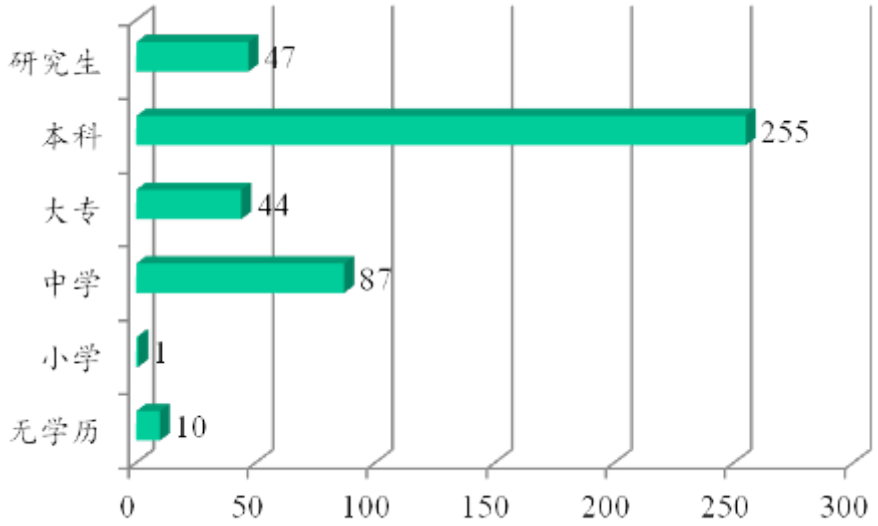



edX

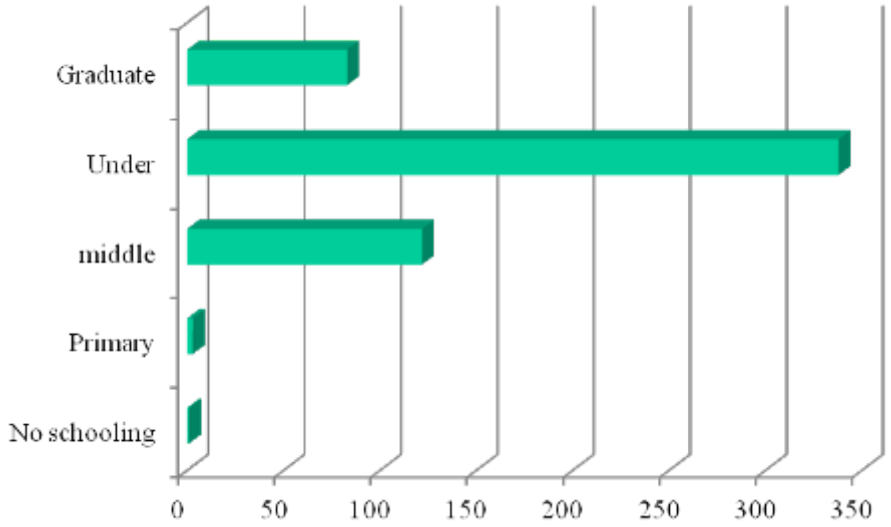


# 第1部分学生学历情况分布

## 学堂在线



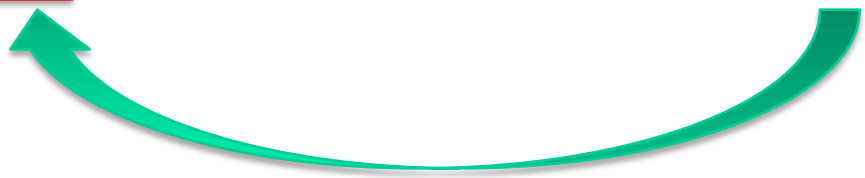

## edX



# OCW(精品资源共享课)←→MOOCs

- OCW
  - 观众在网上看大师给他的学生讲课

  - 课堂搬家
- MOOCs
  - 观众在网上感觉到大师在给他讲课



  - 课程搬家

# MOOCs不是课堂搬家

- 课堂上我们“抓”学生的技巧
  - 随动的PPT
  - 激光笔/教鞭
  - 眼神、手势
  - 走到学生身边
  - 对话
- MOOCs的先天不足
  - 诱惑太多
  - 学生注意力难以长期集中

授课形式要发生重大改变！！

(分合之道)

# 清华大学电路原理MOOC资源

| | week | lecture | video | length | quizzes | exercises |
|---|---|---|---|---|---|---|
| Part 1 Fall 2013 | 1 | 5 | 12 | 0:48:59 | 8 | 6 |
| | 2 | 8 | 15 | 1:25:35 | 13 | 8 |
| | 3 | 6 | 12 | 1:04:47 | 12 | 9 |
| | 4 | 5 | 9 | 1:11:11 | 7 | 6 |
| | 5 | 10 | 18 | 2:14:24 | 17 | 7 |
| | 6 | 3 | 6 | 0:56:18 | 6 | 6 |
| | 7 | 4 | 12 | 1:04:30 | 10 | 7 |
| | 8 | 8 | 19 | 1:59:16 | 16 | 7 |
| Part 2 Spring 2014 | 9 | 7 | 29 | 2:23:45 | 21 | 6 |
| | 10 | 4 | 12 | 1:10:24 | 10 | 8 |
| | 11 | 4 | 19 | 1:38:28 | 12 | 6 |
| | 12 | 7 | 19 | 1:50:40 | 16 | 6 |
| | 13 | 8 | 18 | 1:34:02 | 15 | 6 |
| | 14 | 5 | 13 | 0:59:10 | 11 | 6 |
| | 15 | 8 | 15 | 1:15:34 | 12 | 7 |
| | 16 | 7 | 12 | 0:59:29 | 12 | 8 |
| | sum | 99 | 240 | 22:36:32 | 198 | 109 |

# 知识点路线图

**Week1:Voltage, current, power, and reference direction**

1.why learn circuits?

2.circuits

3.branch variables

4.reference direction

5.power

**Week2:Elements, KCL, and KVL**

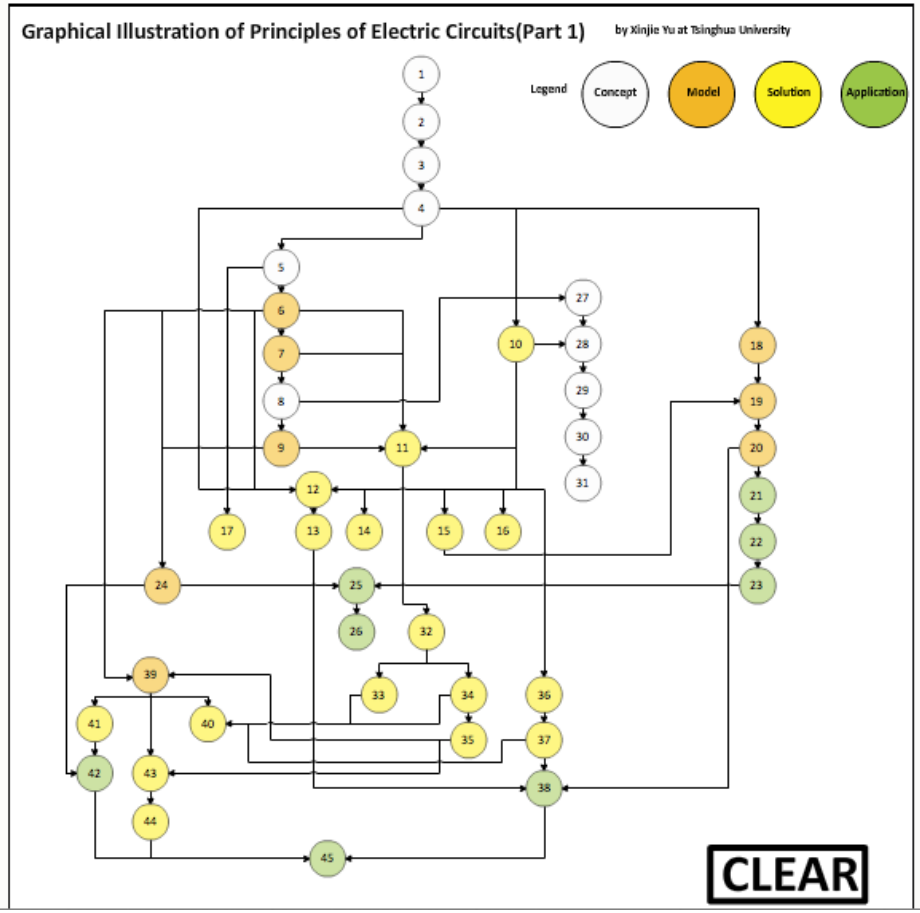
6.resistor

7.independent source

8.port

9.dependent elements

10.KCL KVL



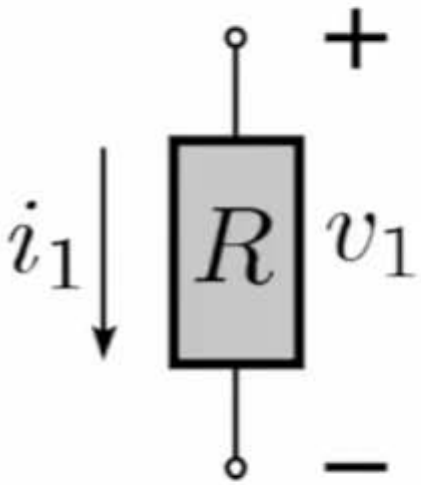
# 当前流行的几种MOOCs授课形式

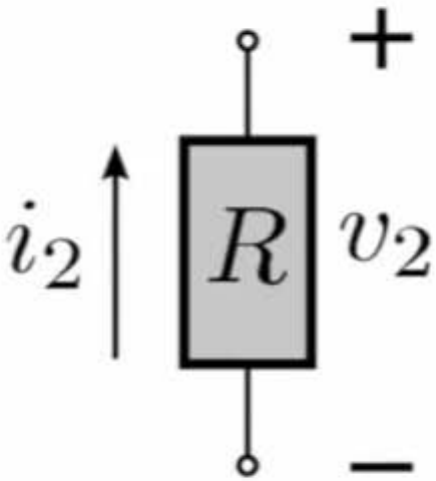
## 1、百家讲坛

# 2、改进三分屏



## Ohm's Law

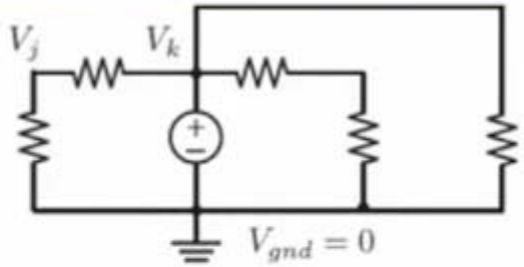



$$v_1 = i_1 R \qquad v_2 = -i_2 R$$

# 3、解释PPT

## Specifying the Reference Node




- Recall that voltage is defined as a quantity that measures the potential difference between two nodes in a circuit, $V_{AB}$.
- We can arbitrarily pick one node of the circuit and define all *node voltages* in reference to this node. Call this node *ground*, or node '0'. In other words, define $V_k$ as the node voltage at node $k$ which is the energy gained per unit charge as it moves from node $gnd$ to node $k$, or in more cumbersome notation, $V_{k,gnd}$.

# 4、变魔术


线性元件
定义
若 U = F( I ) ，
则对任意 A，都有 AU = F( AI )
线性元件
推论
若 $U_1$= F( $I_1$ )， $U_2$= F( $I_2$ )
则 $U_1$+$U_2$ = F( $I_1$+$I_2$ )
网易云课堂
第 1 周
线性电路

# 5、写写画画

**Review:**

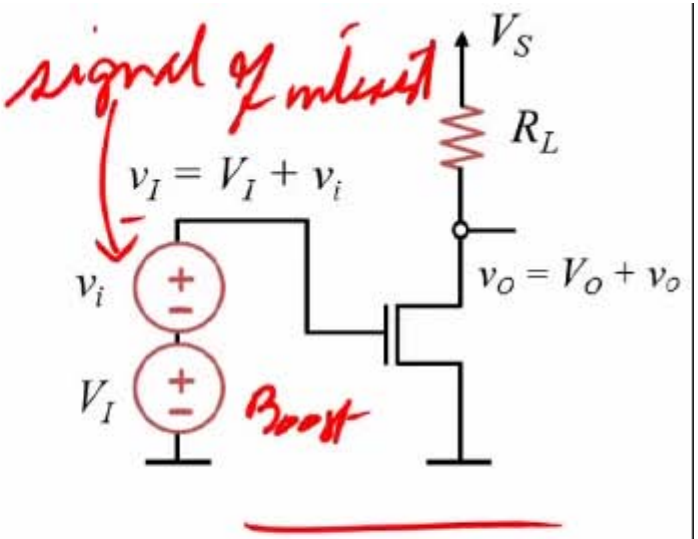
- Small signal notation

$$v_A = V_A + v_a$$

total operating point　small signal

- $v_{OUT} = f(v_I)$

$$v_{out} = \frac{d}{dv_I} f(v_I)\Big|_{v_I = V_I} \cdot v_i$$



# MOOCs在网上“抓”学生的关键

- 有学期
- 有人
- 有交互
- 有嵌入式内容
- 有同学之间的交流
- 有自动评价系统

# 清华大学电路原理MOOC授课实例

## 2、有学期

第2周 元件与基尔霍夫定律 (Elements, KCL, and KVL)

第6讲 电阻(resistor)
讲间练习

第7讲 独立电源 (independent source)
讲间练习

仿真1(simulation1)

第8讲 端口(port)
讲间练习

第9讲 受控元件(dependent elements)
讲间练习

仿真2(simulation2)

第10讲 基尔霍夫定律(KCL KVL)
讲间练习

第11讲 2B法(2B method)
讲间练习

第二周作业(Exercise2)
每周作业 due 2013-10-31 00:00 UTC

调查问卷

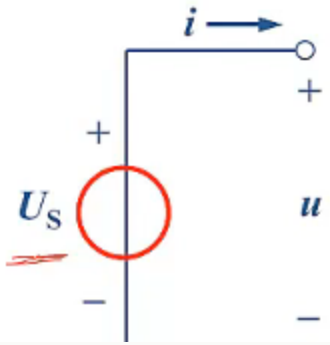
2、有人

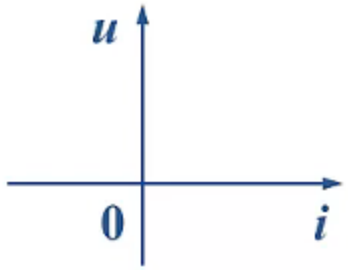
# Principles of Electric Circuits

## L06 Resistors

# 3、有交互

## (2) *u-i* relationship




单项选择题

What's the relationship between the voltage and the current in the previous slide?

- associated reference directions
- non-associated reference directions ✔

最后提交 保存 显示解答 *您已经提交2次，共有3次提交机会。*

非线性电路的分段线性法(PIECEWISE LINEAR METHOD FOR NONLINEAR CIRCUITS)(1)

**Principles of Electric Circuits**

L41 Piecewise Linear Method for Nonlinear Circuits


大家好在此之前的课程里呢

Principles of Electric Circuits by Tsinghua University

大家好在此之前的课程里呢

我们学习了非线性电阻电路的两种分析方法

它们就是列方程求解法

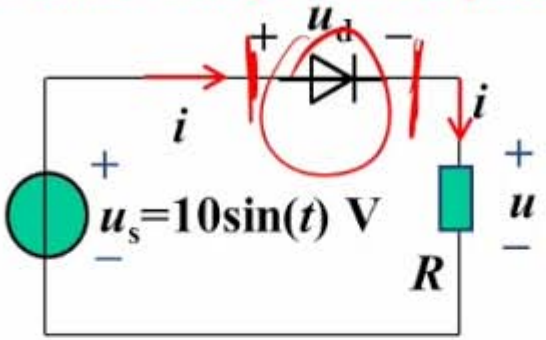
列方程求解法貌似能够得到准确解

但是正如我们此前的课程讲授的

# 视频和讲间练习

# 4、有嵌入

**E2-1 find voltage $u$ with piecewise linear method (ideal diode model 4).**




suppose → verify

**Short circuit Condition: $i > 0$**

**Open circuit Condition: $u_d < 0$**

$i = \frac{u_s}{R} = \frac{10\sin\omega t}{R}$

$> 0$

$\sin\omega t > 0$ OK

$u_d = u_s = 10\sin\omega t < 0$

$\omega t < 0$ OK

simulation experiment

# 5、有交流

## important circuit simulators

TariqBilal

SORT BY: DATE VOTES COMMENTS

| | | |
|---|---|---|
| too late to start? | +3 | 6 |
| Help for week three L12. | +1 | 9 |
| important circuit simulators | +21 | 33 |
| Course Book / Reference Book | +7 | 17 |
| Free math software | +10 | 18 |
| **Students Introduction Area** | +8 | 49 |
| Students from different cultures | +11 | 13 |
| On Wiki | +2 | 16 |
| Free circuit simulators for help learning this course | +19 | 33 |
| Possible solution (temporary) for machine-reading the caption text file while watching the video | +16 | 30 |
| English speakers ? | +11 | 43 |
| Terms for Wiki in week 3 have been added | +1 | 2 |
| We will provide videos download recently | +6 | 4 |
| Cannot submit answer to week two | +0 | 6 |

## 第十一讲2B法习题参考答案错误

+ 0

IvyWQY
*about 24 hours ago*

该讲习题三个答案中的后两个顺序写反了，4个支路4个节点，那么b=4，n=4，则可列写n-1个即3个独立KCL方程和b-n+1即1个独立KVL方程，而给出的参考答案却是1个KCL方程和3个KVL方程。请老师和各位同学检查。

置顶话题 报告错误

编辑 × 删除 关闭

csyang8109
*16 days ago*

Hey! I am a M
precision eng
the future! :)

Edit ×

Add a com

dzxxbj
*about 22 hours ago*

+ 0

答案是对的，开始也把节点当成了4个，实际是2个。因为第10讲的第二个视频老师给出定义了：

> 支路:是若干彼此相连同时又没有分权的元件的整体;
> 结点:是连接三个或者更多支路的点。

图中上边第一和第二个交点其实收缩为一个节点，因为中间的导线不是支路，因为参照定义支路至少有一个元件；
图中下边第三和第四个交点也收缩为一个节点，理由同上,因此实际的n=2。

支路对照定义共有b=4条。

MarkCarter
*16 days ago*

+ 0

hi, Teaching high school physics in Mozambique. My name mark and English. Enjoying course like the way prof puts things in a fundamental way.

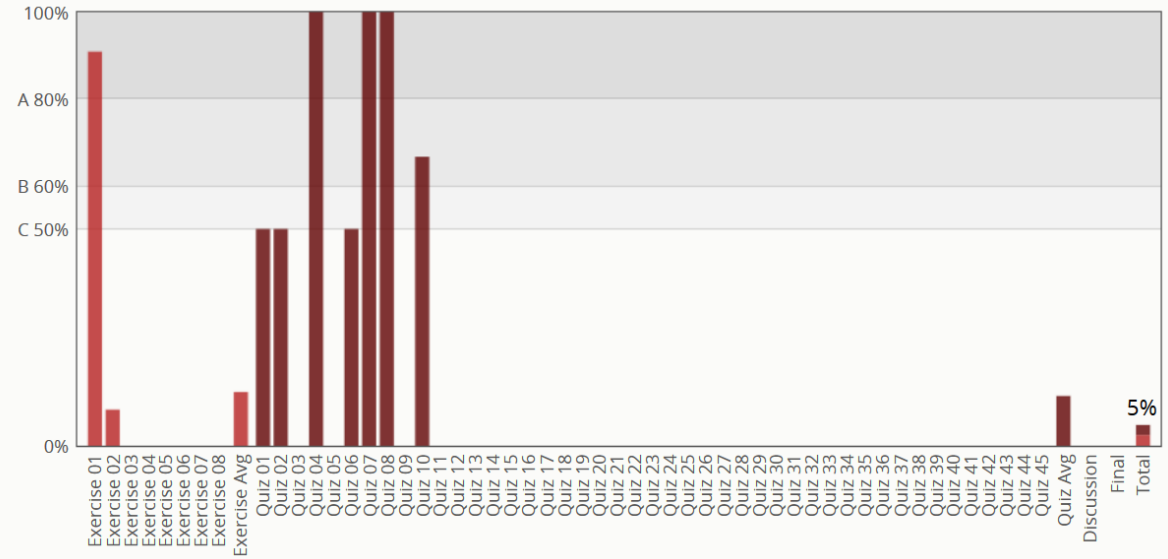
Report Misuse

Edit × Delete

Add a comment...

# 6、有自动评价

学生 'yuxinjie' (newhero.yu@gmail.com) 的课程进度

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- 已发表论文或出版教材（某章） 不能上载到网站

# MOOCs的几大特点

- 教师 → 精英化
- 对象 → 多元化
- 平台 → 集成化
- 知识 → 碎片化

# MOOCs与实体课堂的关系

- 竞争者？
- 互助者？
- 催化剂？

# 几种可能的MOOC落地之道

- a校学生在线学习该MOOC，参加a校考试，获得a校学分
- a校教师用该MOOC做翻转课堂
- b校学生学习该MOOC，参加b校考试，获得b校学分
- b校教师用该MOOC做翻转课堂，基本情况类似
- b校学生学习该MOOC，参加a校组织的考试，获得a校学分，被b校认可

# 关于MOOCs和SPOCs的小结

- MOOCs给我们提供了与世界顶级课程同场竞技的难得机遇
- MOOCs是课程搬家，不是课堂搬家
- 想在网络环境下吸引学生有不少技巧
- MOOCs和课堂教学不是替代关系
- SPOCs（翻转课堂、混合式学习）是在线教育在大学校园中的真正价值

# Let us be open !

Open
or
Obsolete