cuc-2001

cuc-2001

cuc-2001

cuc-2001

cuc-2001

cuc-2001

cUc-2001

cuc-2001

cUc-2001

cUc-2001

cUc-2001

cUc-2001

cUc-2001

cUc-2001

cUc-2001

cUc-2001

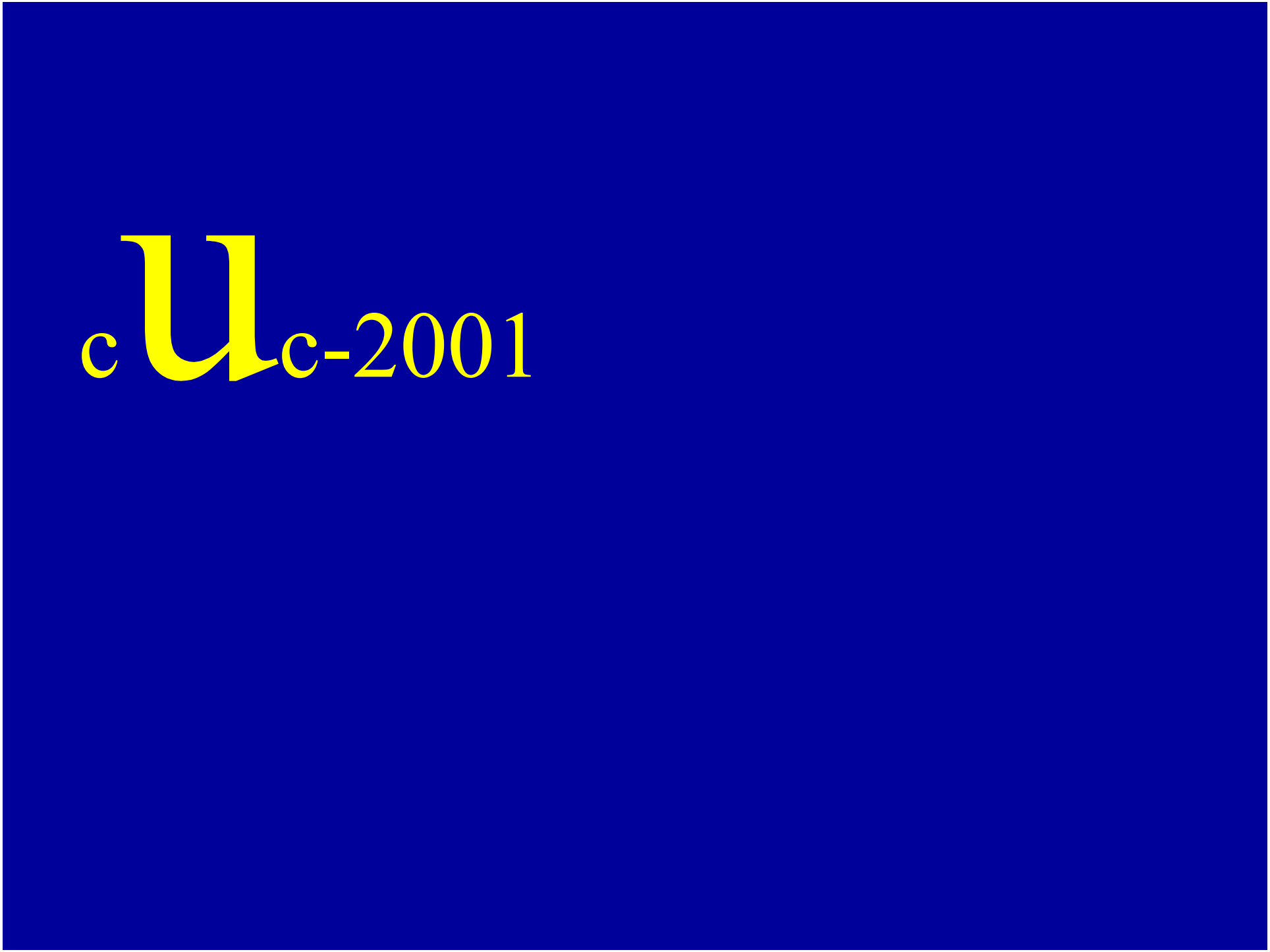
cucc-2001

cucc-2001

cUc-2001

cuc-2001

cUc-2001


cUc-2001

cUc-2001

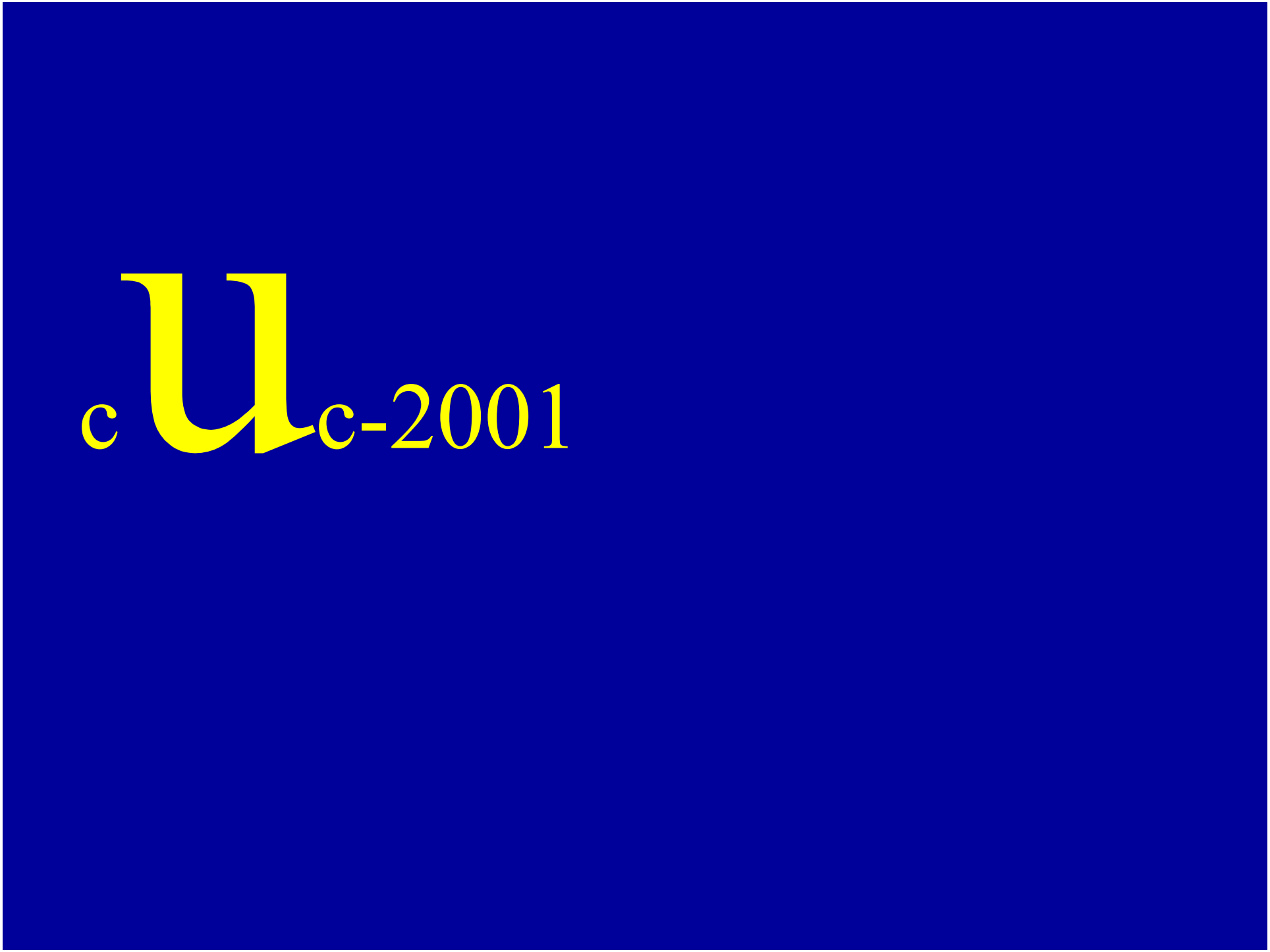

cUc-2001

cUc-2001

cUc-2001

cUc-2001


c u c-2001


c u c-2001

users

users

users

users

users

users

users

users

users

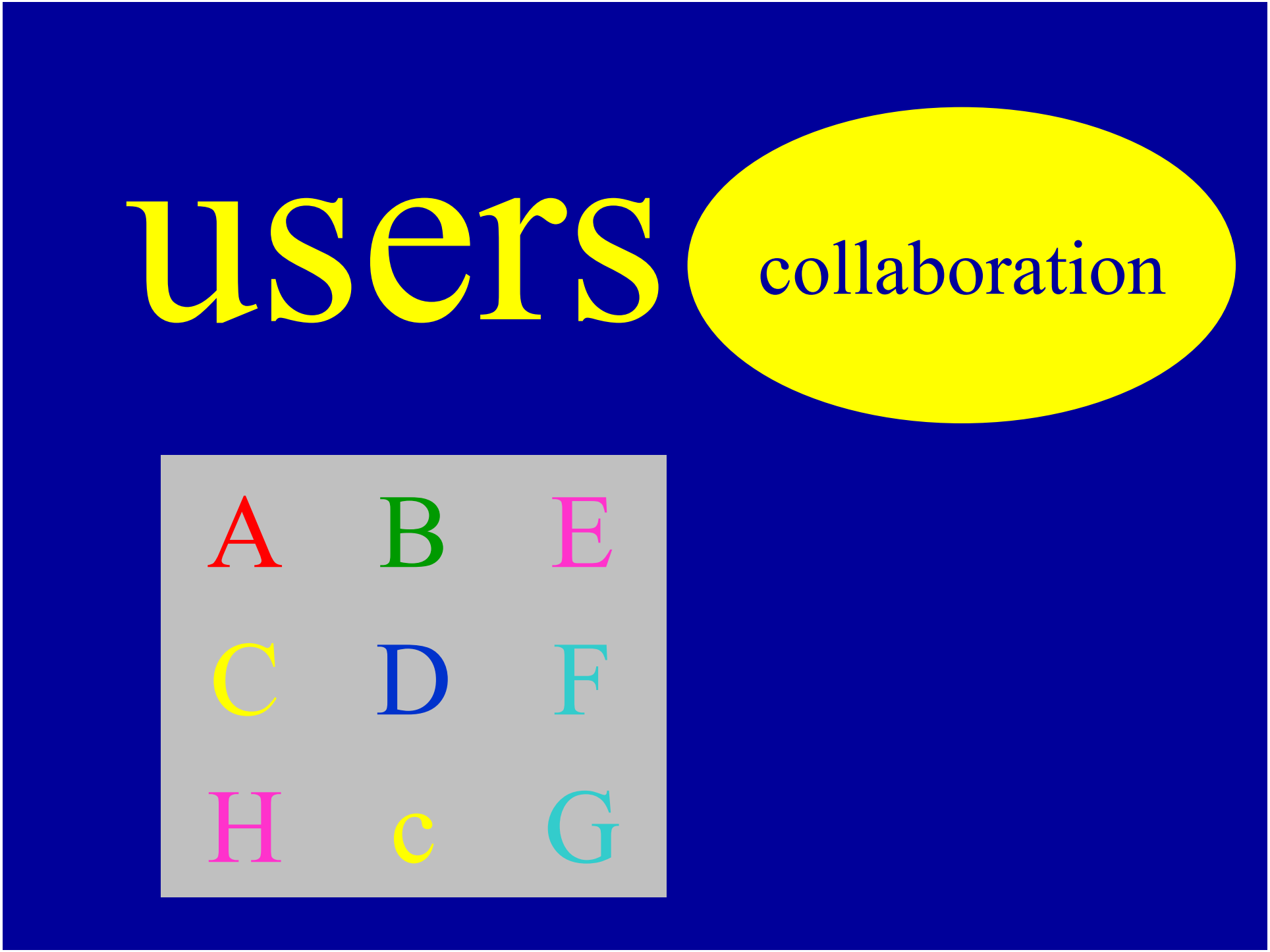
users

users

users

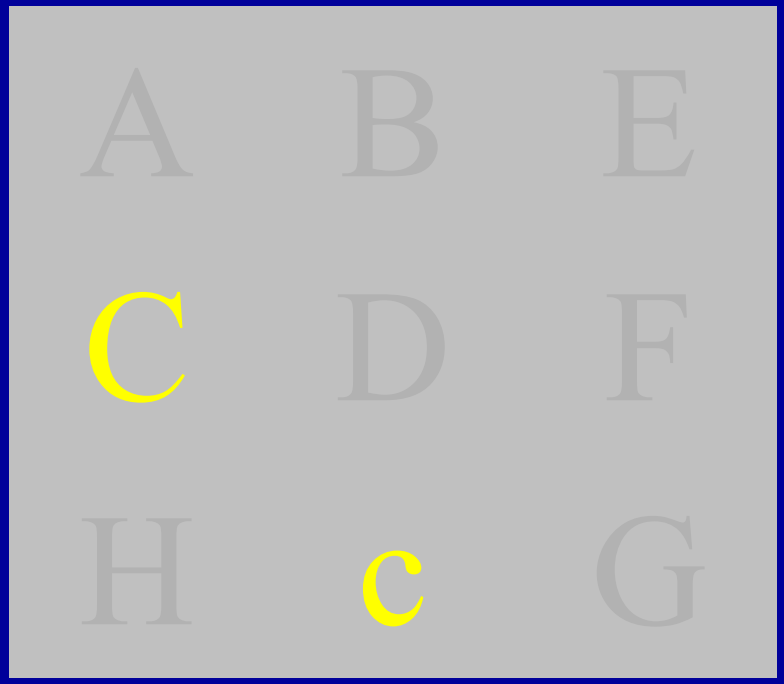
users

users


users
collaboration
A B E
C D F
H c G

users

collaboration



PhD Predrag Valožić

Polytechnic of Zagreb

Classroom, laboratory and WWW integration in teaching Telecommunication Fundamentals - initial experiences, plans and vision -

In Telecommunication fundamentals teaching, we use:

Analytical models (lectures)

Numerical models (examples)

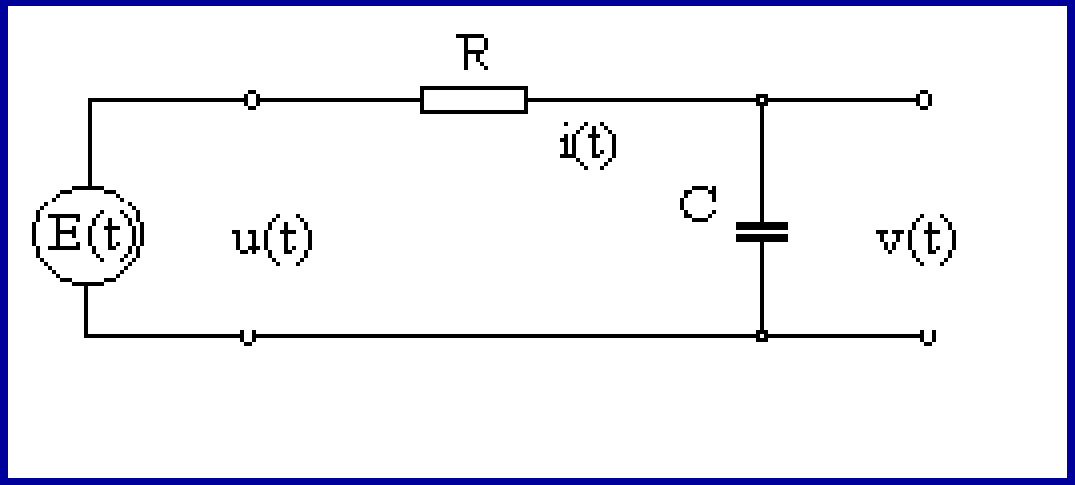
Laboratory models (experiments)

Graphical models (diagrams...)

Problem ?

Analytical model of a simple RC-filter

Models



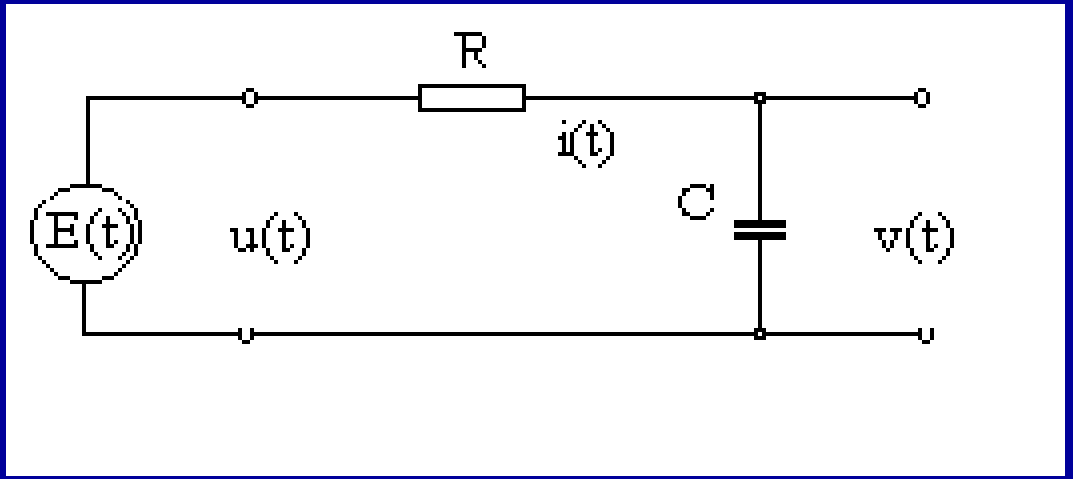
$$v(t) + R \cdot i(t) - E(t) = 0$$

$$v(t) = v(t_0)\, e^{-P(x)} = v(t_0) \exp(-\frac{t - t_0}{RC})$$

Models

Numerical model of the same RC-filter

$$\frac{V}{U} = \left| \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} \right|$$



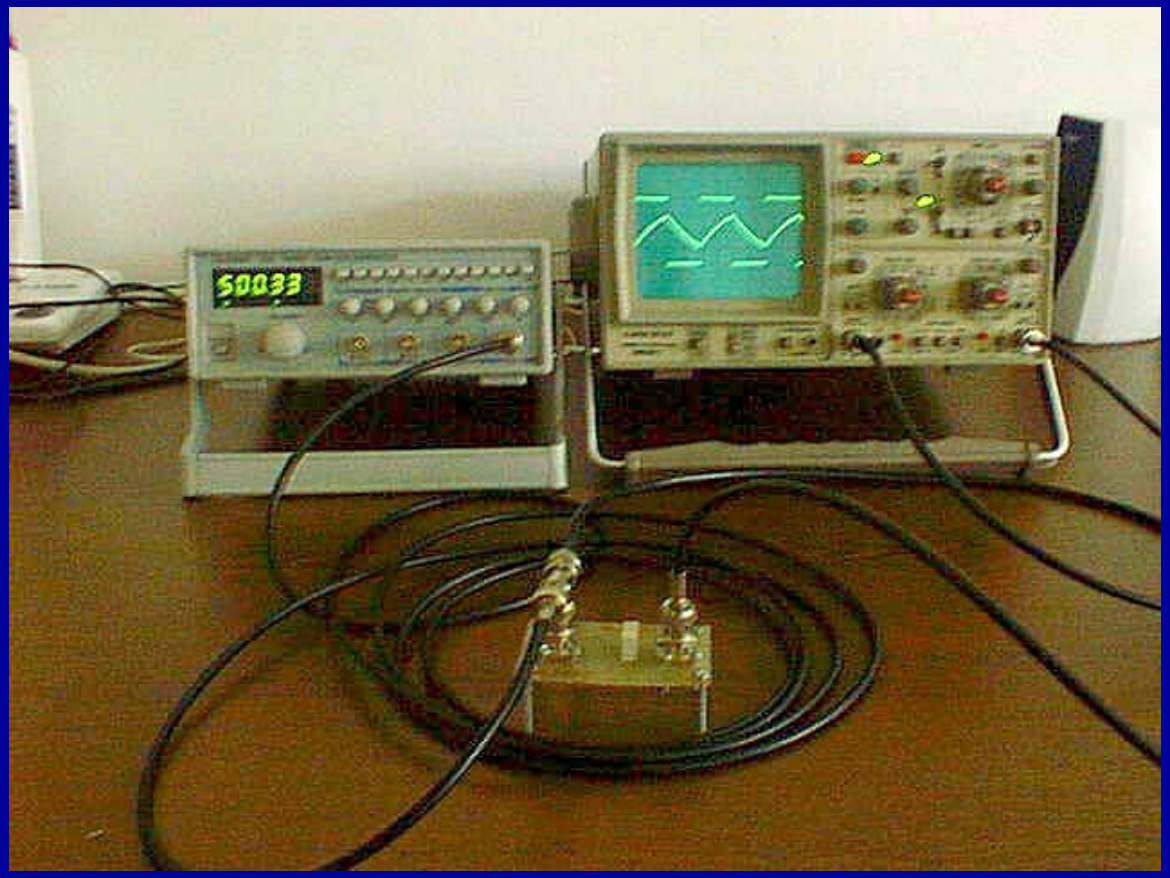
Let R = 10 kΩ, C =0,1 μF.

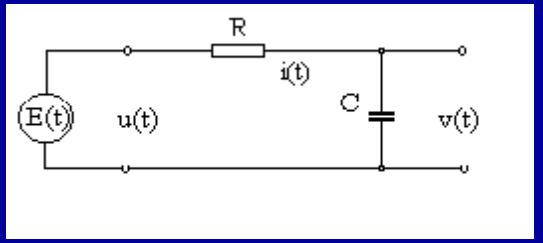
$$\frac{V}{U} = \left| \frac{1000}{1000 + j\omega} \right|$$

f=1 kHz, U = 1 V $\rightarrow$ V = 0,1572 V

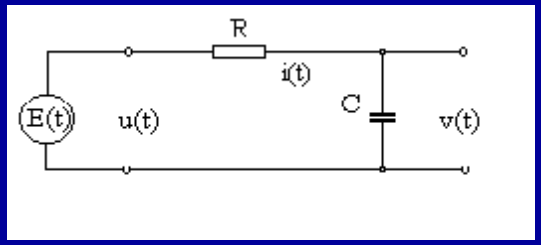
Models

Experiment:



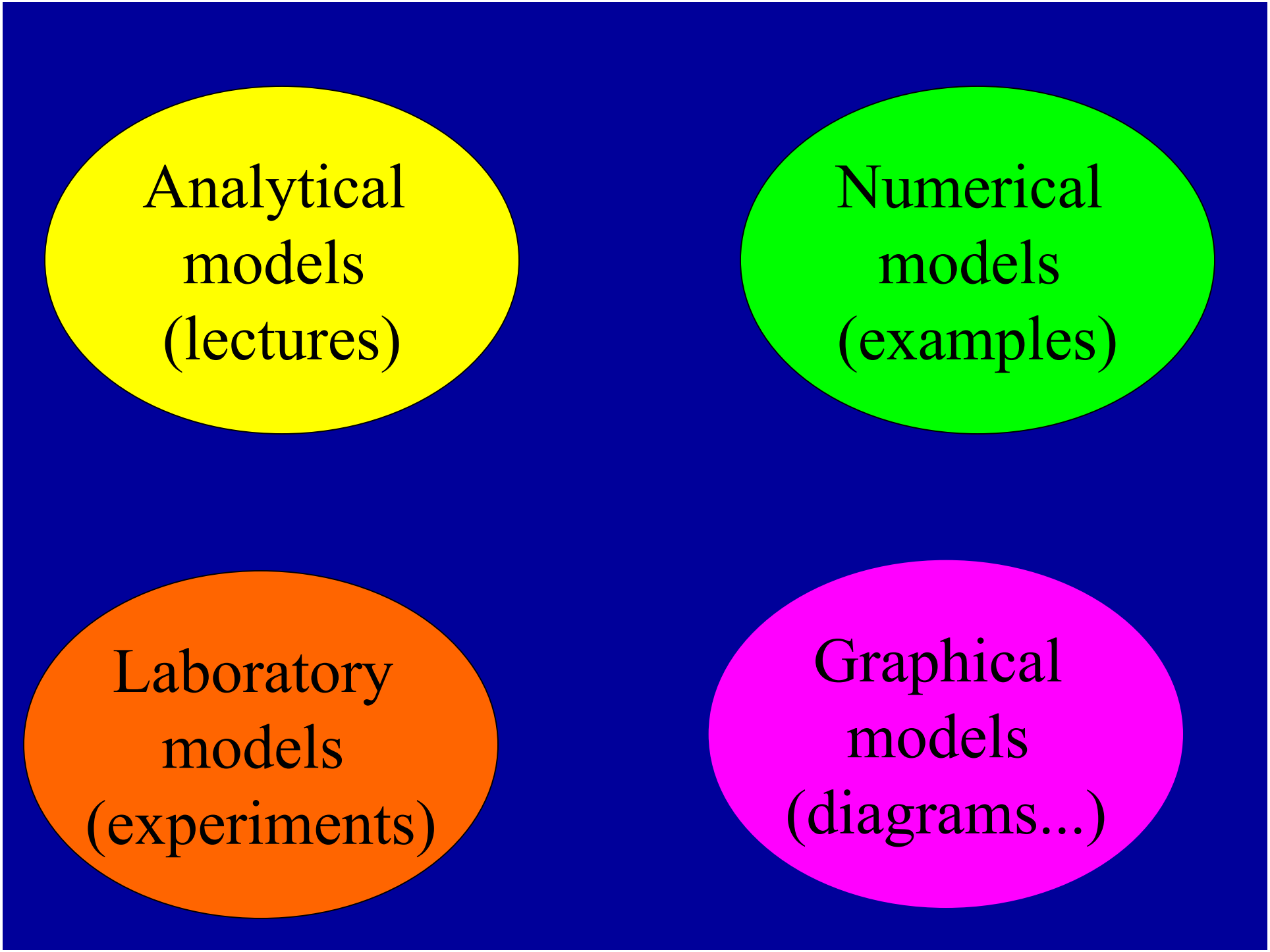


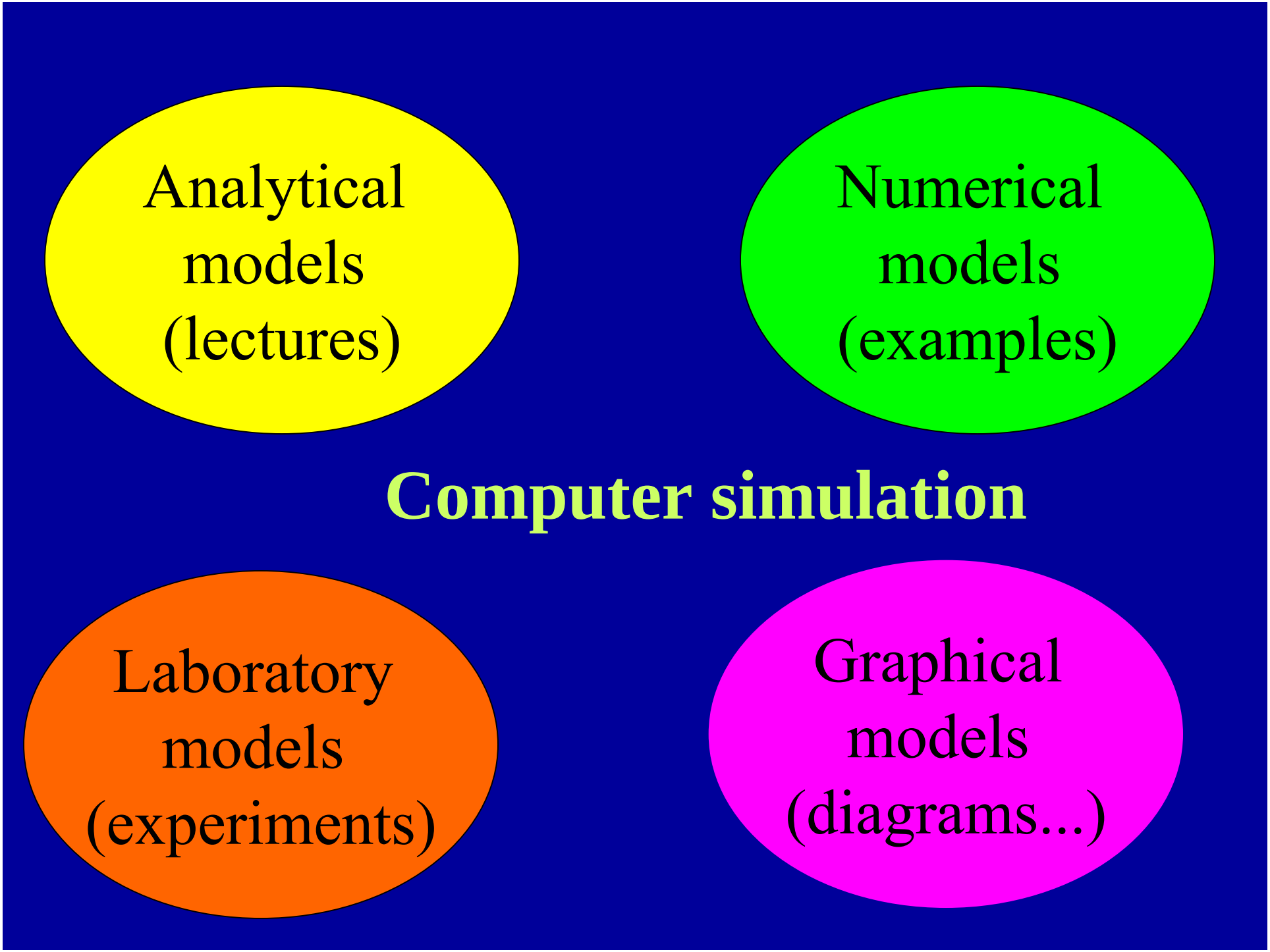
For students:

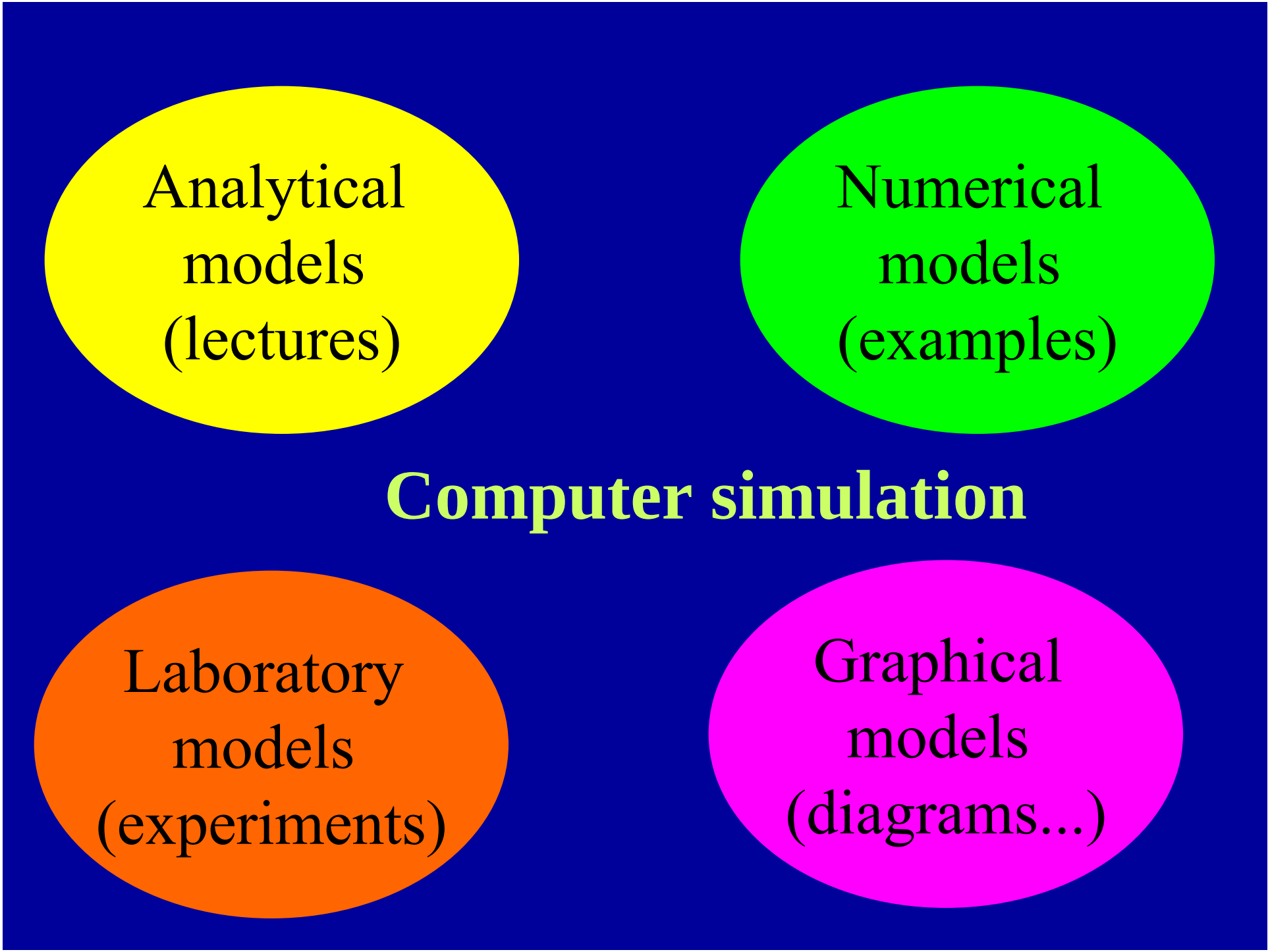


- It is not so easy to understand what is going on with signals in the simple RC circuit.

- **It is “impossible” to predict what will happen in the case of complex systems and random digital signals!**


Analytical models (lectures)
Numerical models (examples)
Laboratory models (experiments)
Graphical models (diagrams...)


Analytical models (lectures)
Numerical models (examples)
Computer simulation
Laboratory models (experiments)
Graphical models (diagrams...)


Analytical models (lectures)
Numerical models (examples)
Computer simulation
Laboratory models (experiments)
Graphical models (diagrams...)

Collaboration project :

Seamless integration of

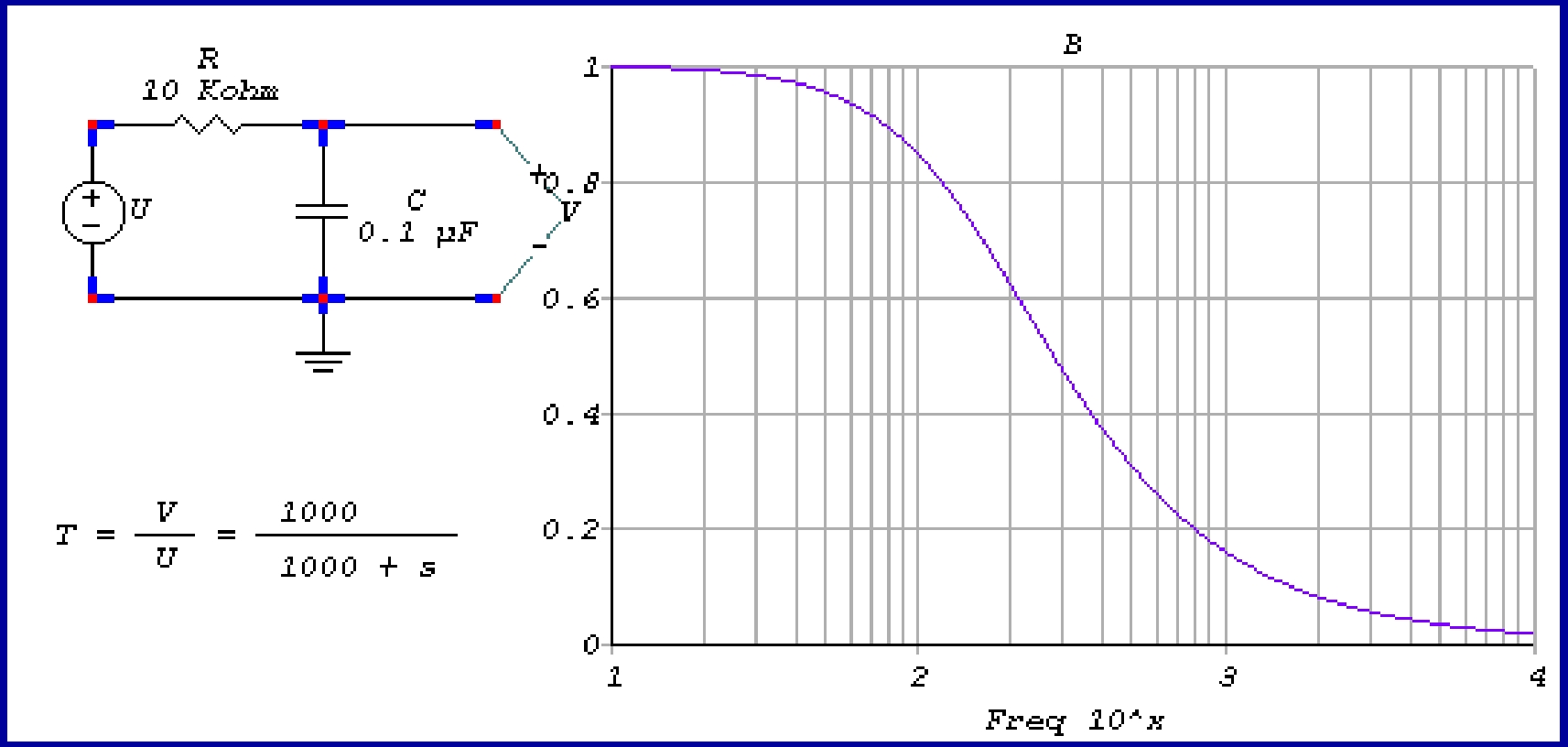
- **analytical and numerical models,**
- **simulation and**
- **experiment**

in digital signal transmission analysis.

Practical goal:

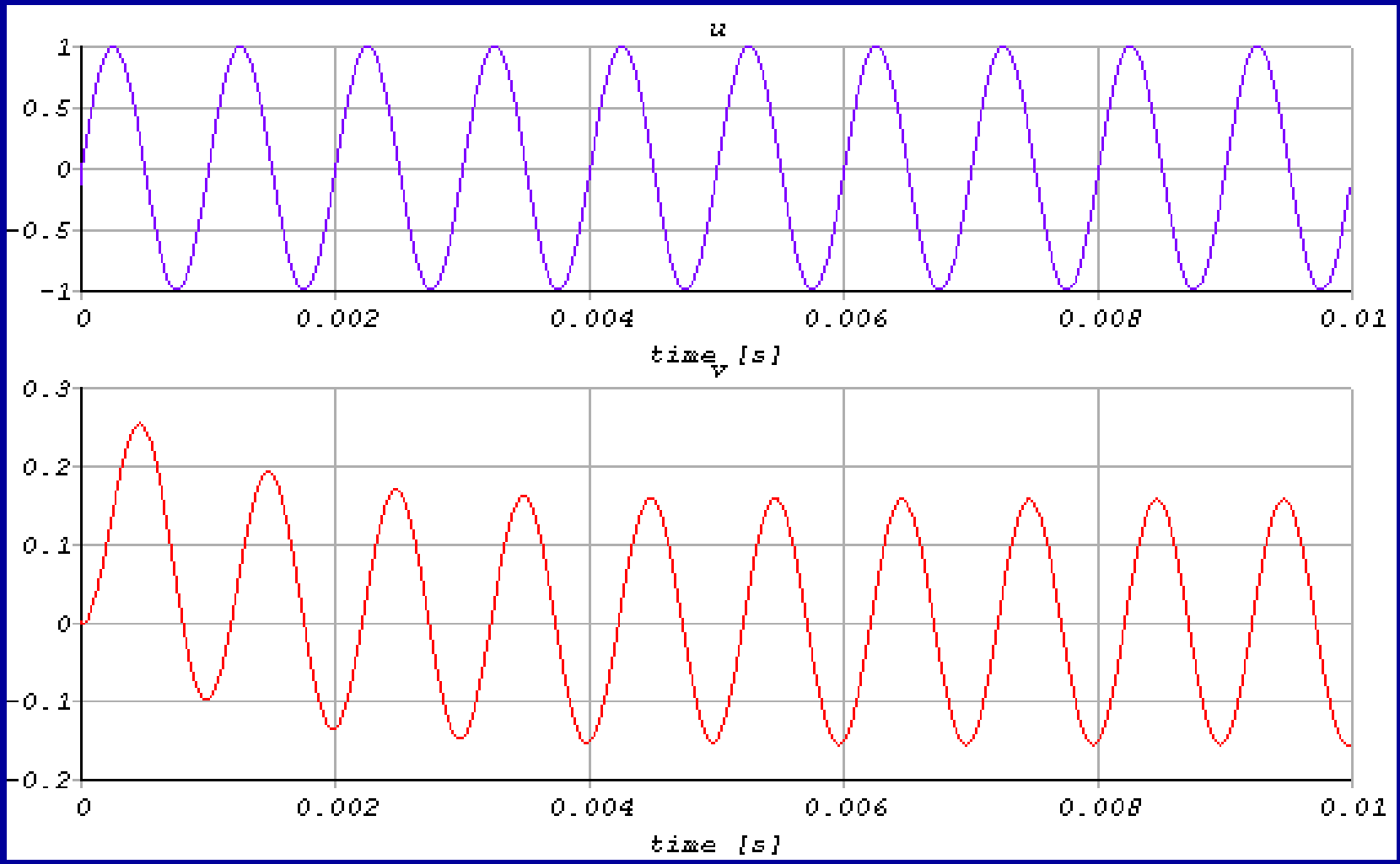
Laboratory exercise development and evaluation.

Simulation: CircSolv

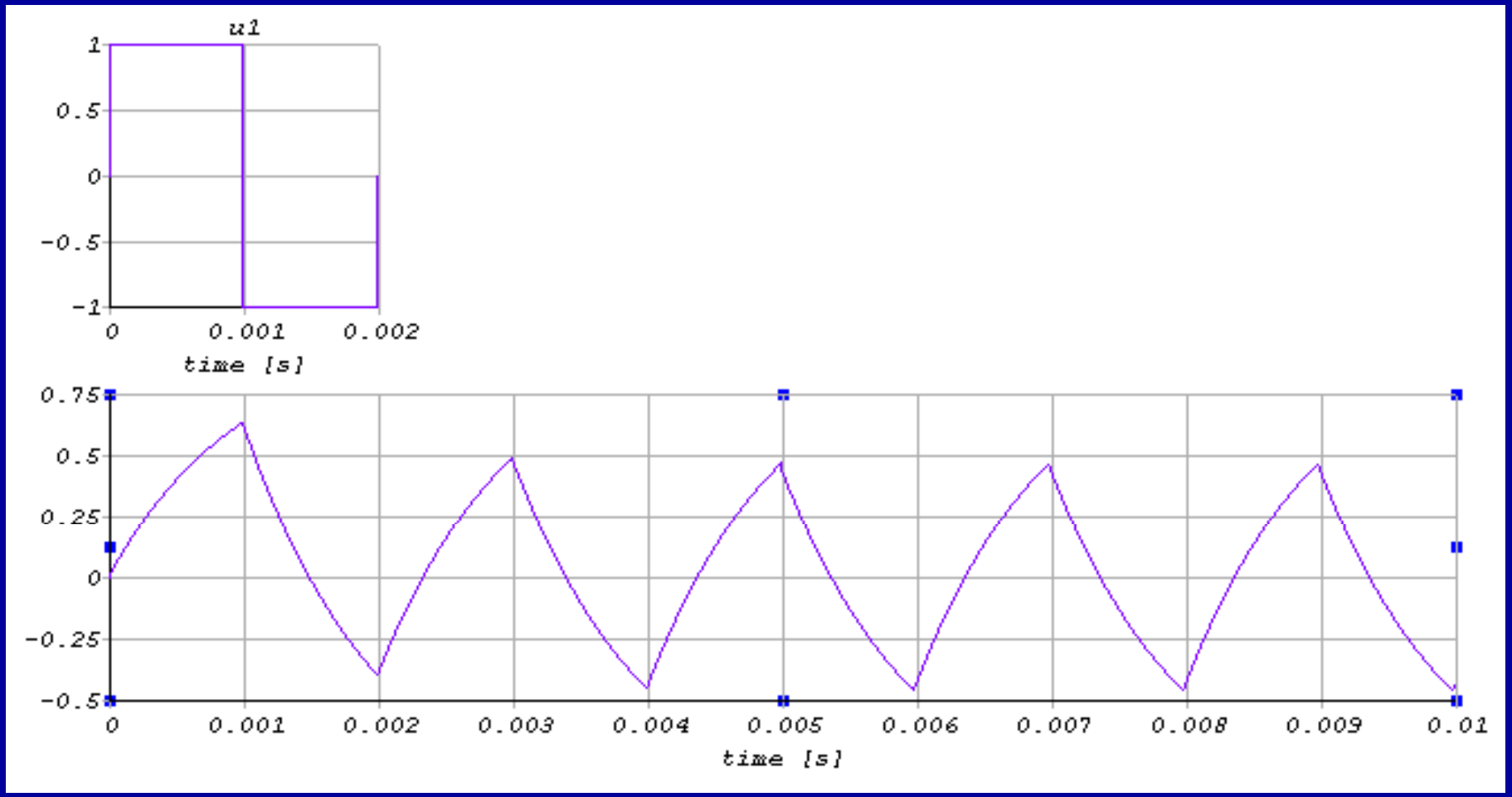


$$T = \frac{V}{U} = \frac{1000}{1000 + s}$$

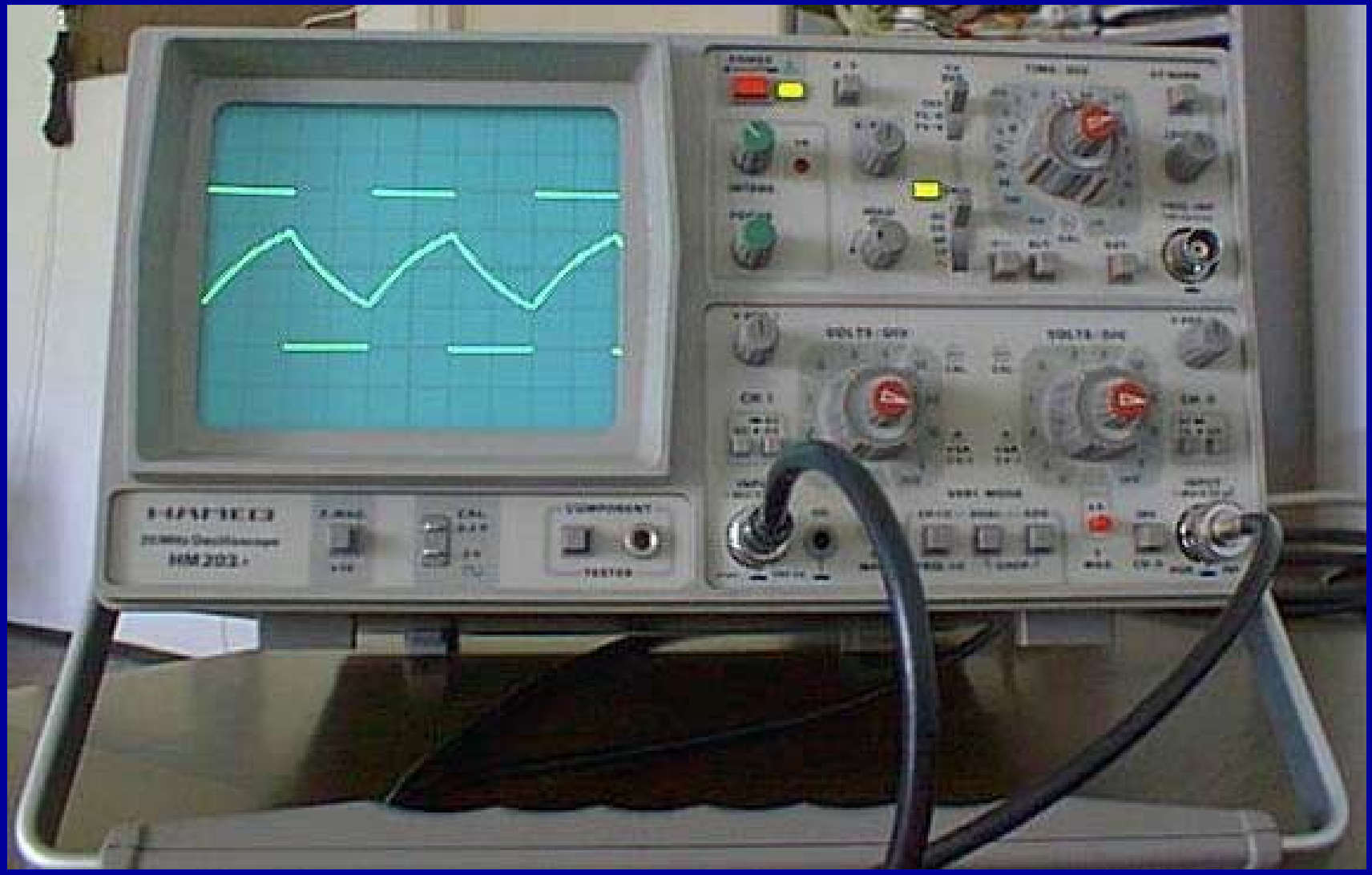
RC circuit, transfer function equation and amplitude characteristic



CircSolv results: harmonic input and output signals, f=1 kHz



Periodic bipolar pulse input, and saw-tooth output signal f=500 Hz


HAMEG
HM 203-6
COMPONENT
TESTER

Great degree of agreement among theory, simulation and experiment is evident.

It is possible to choose the most suitable model.

What about WWW, Internet, communication and collaboration?

WWW is a **library**:

- Literature source
- CircSolv downloaded as share-ware.
- On-line book store.
- Support; book with "personal" Web page:
  - help for instructors and students,
  - illustrations suitable for lecture notes or PowerPoint lectures,
  - examples with solutions.
- Java applets simulations suitable for animated presentations.

WWW as **communication** tool:

- All communication between project participants was performed by electronic means.
- Internet (e-mail) was the most important media.
- Laboratory manuals and work sheets were published on WWW.

And finally, **collaboration**?

Study subject development cooperation with students is of great help:

- Documents technical preparation,
- Error correction,
- Improvement of certain formulation,
- Time planning etc.

Product: Lab. exercises manual on digital signal transmission over UTP cable.

Conclusion

Project has to be computer supported and communication dependent.

Communication depends on project organization:

- Independent, random and asynchronous,
- Interdependent with mediator activated communication sequences
- Synchronous or simultaneous communication (virtual conference, virtual classroom or virtual laboratory)

Certain expectations about IP communication were remarked and proven:

- Internet is unreliable and random

- Today's Internet attempts to deliver all traffic as soon as possible within the limits of its abilities, but without any guarantees related to throughput, delay, delay variations (jitter) and packet loss ("best effort" paradigm)

Probability of successful message transmission and delivering depended on availability of CARnet system, starting with LAN at Polytechnic of Zagreb, CARNet server at SRCE, HT ISDN System etc.

It is evident that in the case of simultaneous (real-time, interactive) collaboration, communication availability and reliability has to be close to PSTN (0,99999 **five minutes** of downtime per year).

Plans:

Close future

Multi-level collaboration project at Polytechnic of Zagreb.

Next future ?

National collaboration project?

Far future ??

International collaboration project??


STOP