



University of Algarve
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EXP.AT'17

The VISIR+ Project – Helping Contextualize Math in an Engineering Course

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VISIR (Virtual Instrument Systems in Reality)

This Laboratory was developed for remote experimentation on electricity and electronics. It is based on **virtual Instrumentation**, i.e., real physical instrumentation accessible through virtual interfaces.



Global Online Laboratory Consortium



The GOLC Online Laboratory Award 2015 in the category

„Remote Controlled Lab“

is presented to

VISIR (Virtual Instrument Systems in Reality)

Submitted by:

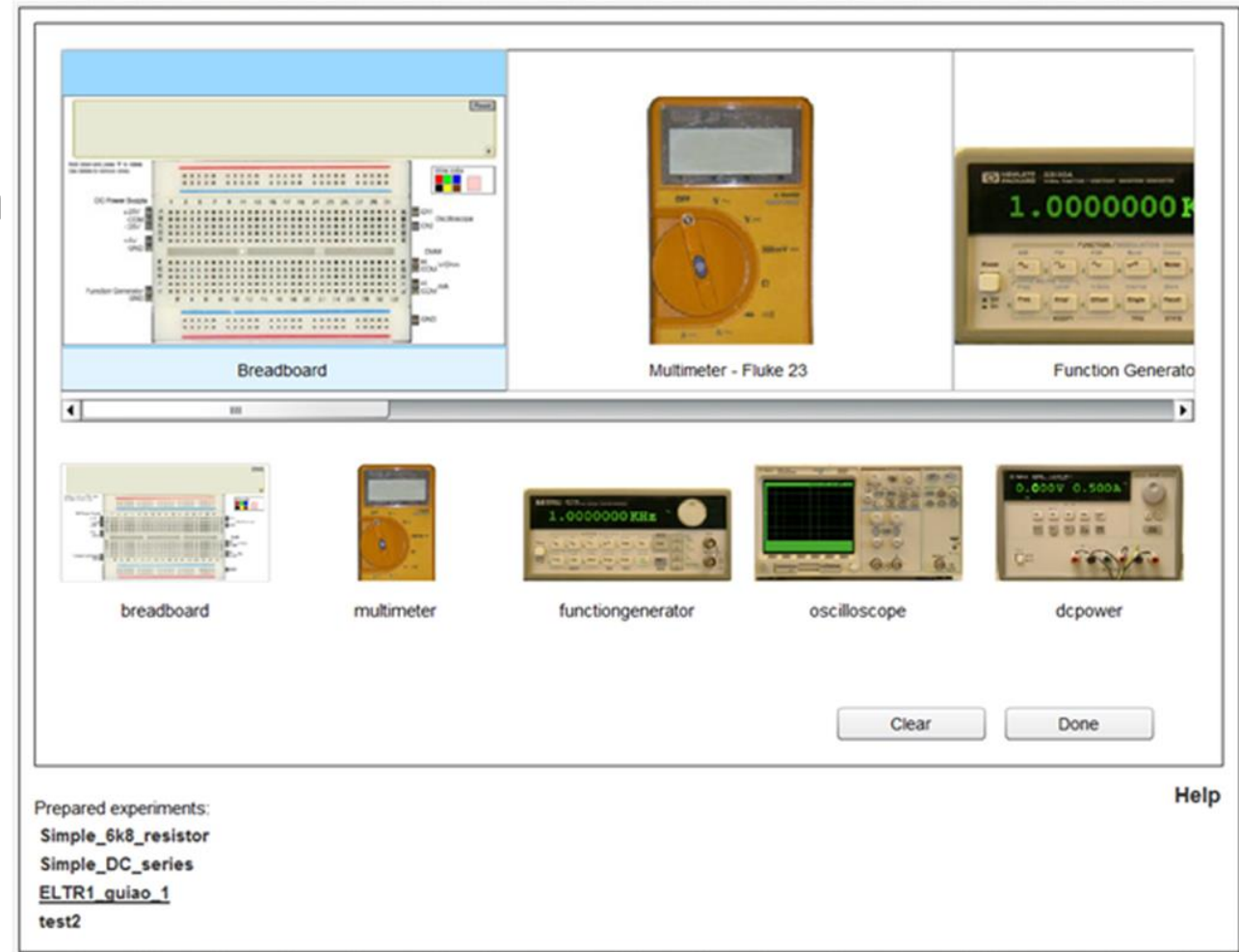
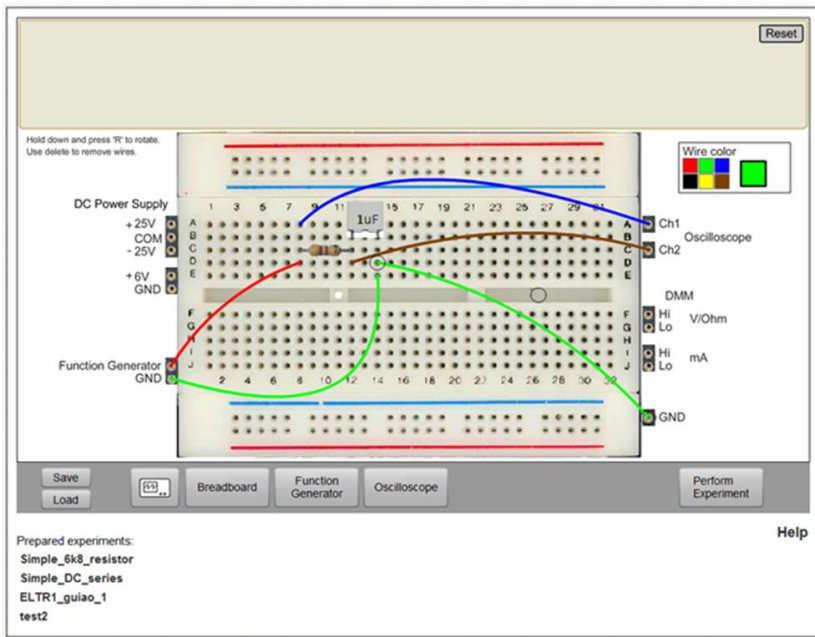
Ingvar Gustavsson, Gustavo Alves, Thomas Fischer, Javier Garcia Zubia, Felix Garcia, Manuel Castro

Awarded during the 12th International Conference on Remote Engineering and Virtual Instrumentation (REV2015) in Bangkok, Thailand


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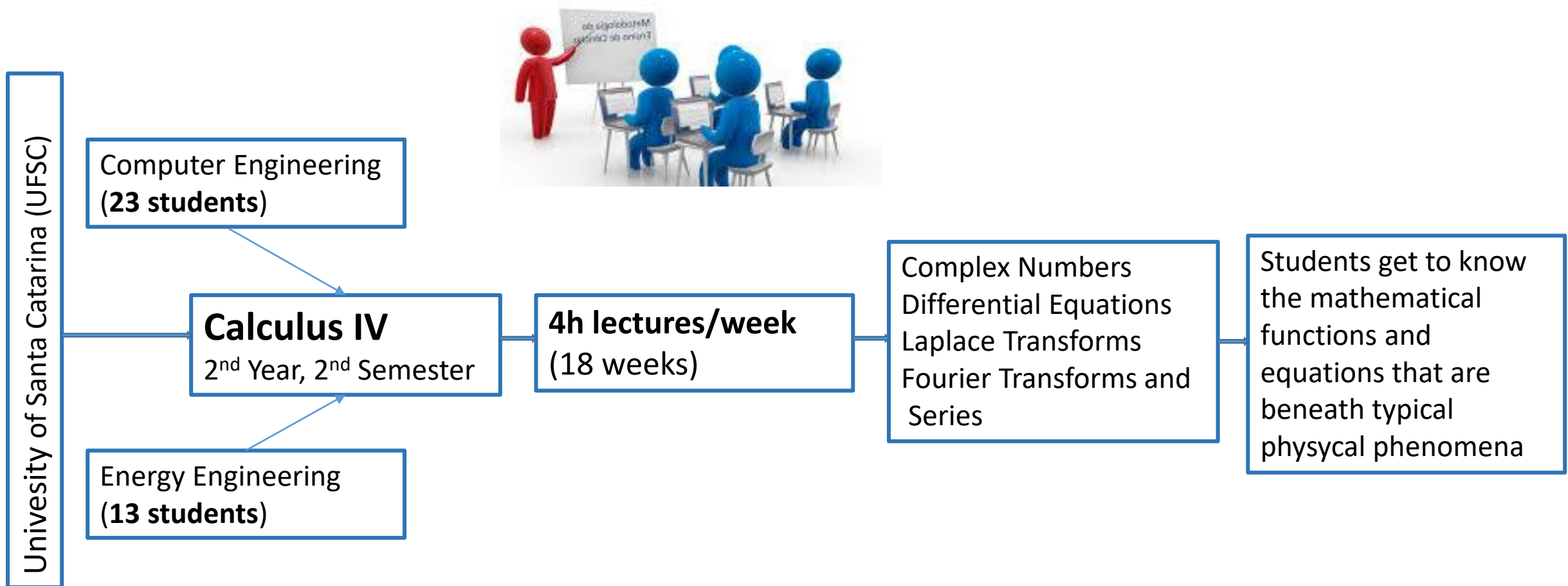
VISIR includes control and monitoring instruments, power supplies and a switching matrix to interconnect them to several components.



VISIR+ brings together the power of the best remote lab for experiments with electrical and electronics circuits and the long history of collaboration among the consortium partners from Argentina, Austria, Brazil, Portugal, Spain, and Sweden.



- This project targets the broad area of Electrical & Electronics Engineering, and, within it, the subject of circuits' theory & practice.
- It aims to define and develop a set of educational modules comprising hands-on, virtual, and remote experiments, the later supported by a remote lab → VISIR, combined with calculus, following an enquiry-based teaching and learning methodology.



- **Contextualization** - The teacher wanted students to visualize and assemble electric and electronic circuits to relate the mathematical concepts to the electricity and electronics:
 - Simulation
 - Graphic Tools
 - Calculus
 - **VISIR** Remote Lab

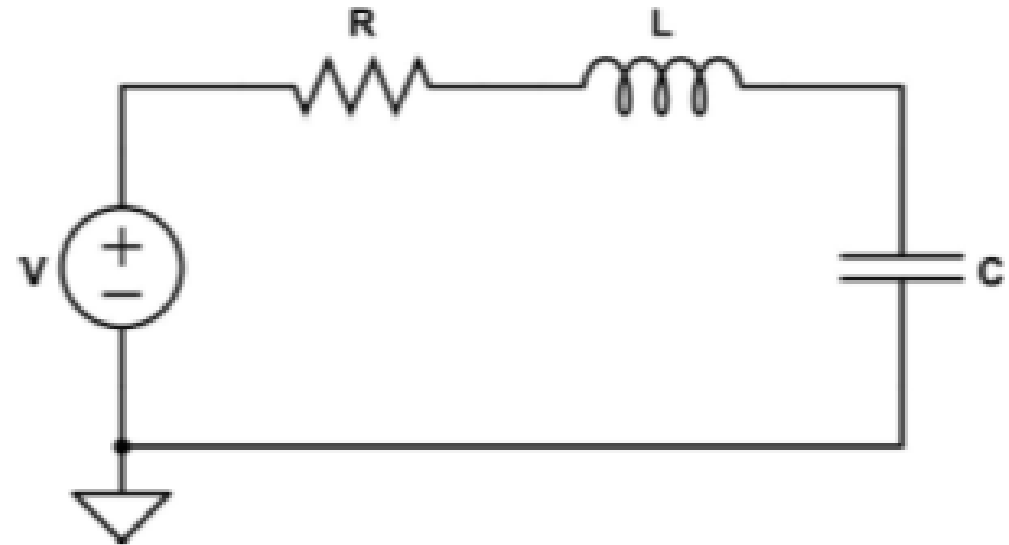
VISIR was their first experience with electrical circuits lab work

- **VISIR** introduced in the 3rd week of the semester
 - 1st Class: the teacher started by demonstrating assembling a circuit
 - 2nd Class: students tried the resource themselves (using their own computers), following teacher's instructions
 - the teacher prepared a tutorial 5-min video
- **VISIR**: a task proposed in 3rd week covering, about 20% of the courses' content, to be delivered in the 10th week
- **VISIR** used autonomously by students

- Assessment Plan

Week 3	VISIR Introduction by Teacher		VISIR Autonomous Usage by Students
Week 4	VISIR Usage in Class		
Week 5			
Week 6	Written Test_1	40%	
Week 7	VISIR Tutorial		
Weeks 8-9			
Week 10	Deliver Task_1	10%	
Week 11			
Week 12	Written Test_2	30%	
Weeks 13-15			
Week 16	Deliver Task_2	10%	
Week 17			
Week 18	Deliver Task_3	10%	

- **Task 1** consisted on the analysis of one RLC circuit, using two different voltage sources
- Students had to use **three different resources** – calculus, simulation and VISIR to calculate the electric current and the voltage drop across the inductor
- Students had to do a report **comparing and analyzing the results obtained with the three resources**



RQ: “Which are the advantages of using simultaneous different online lab resources to contextualize a math calculus theoretical course?”



Test assignment results
were crossed with their
attendance to classes and
their use of VISIR

Students'
Satisfaction
Questionnaire

Teacher' perception of the
didactic intervention:
Satisfaction Questionnaire
and Interview

- In general, students' performed well → (64% completed the course)
- Students achieved a better result in task 1

	Number of Students	Minimum Grade	Maximum Grade	Average Grade
Task_1	24	6,0	10,0	9,1
Task_2	23	0,5	10,0	7,2
Task_3	29	3,5	10,0	8,8
Test_1	29	1,5	10,0	5,7
Test_2	30	0,5	10,0	6,5
Final	30	2,0	10,0	6,4

Compare average grades obtained by students who delivered task 1 (**Group1**) with the average grades obtained by all the class (**Group All**)

	Group All	Group 1	Difference
Task_1	9,1	9,1	-
Task_2	7,2	7,4	0,2
Task_3	8,8	9,4	0,6
Test_1	5,7	6,2	0,5
Test_2	6,5	7,1	0,6
Final	6,4	7,1	0,7

Students who delivered task 1,
performed better in all components

Last year average grade 6,1

Statistical Analysis - to assess the significance of the use of virtual resources as well as class attendance in the grades per task/test and final grade

	Task_1	Task_2	Task_3	Test_1	Test_2	Final
Task_1	1	0.497**	0.533**		0.500**	0.389*
Class Attend	0.389*	0.350*	0.884**		0.366*	0.738**

There is a significant correlation between the use of several resources and the grades obtained in each task/test (except for test 1) as well as class attendance

- 20 students (55%) answered it: 20 closed Qs + 2 open answer Qs
- Students' autonomous work (1, 7, 11 & 19):
 - it was not hard to find time to perform the assigned experiments
 - they frequently performed experiments due to the possibility to use it 24/7
- Development of practical, experimental and reflexive skills (3, 5, 6, 12 & 14):
 - 16 students tried the experiments many times if they thought measures were odd
 - 16 students found the measurement devices easy to use
 - only 4 students (20%) prefer hands-on experiments to remote labs
 - almost all of them (17) were less afraid of damaging the remote lab system

Most interesting about VISIR

Ideas	# of answers
real lab resemblance	5
the possibility of performing experiments without the need of a real (physical) laboratory	4
ease of use	4
practicality	2
the fact of experimenting in any place and time	2
the variety of resources and functions	2
visualization of results	2
risk avoidance	2
all over the world	1
time saving (cutting and unscrewing cables)	1
the possibility to design circuit as desired	1
everything	1

Which problems they found

Some kind of error: *server error* and *an eventual error in the reading on the oscilloscope*

I did the experiment and worked correctly, I repeated the same experiment but it no longer worked as expected.

- He considered VISIR was an excellent resource, easy to use with a friendly interface and components suitable for his needs
- He stated that *it was a huge advantage to have access to an actual lab during this rather theoretical course of Calculus. The lab served initially as a motivation for the methods and later for their verification in real circuits. Although the performance of the remote lab was unstable at times, it did not prevent students from using it.*
- The teacher considered that there were 8 students (22% of the enrolled students) achieving higher order competences and that VISIR usage largely contributed to it (increase of 8%)

- He acknowledged that VISIR increased students' motivation, their commitment and ultimately their general performance
- His advice for those who plan to use it, is to give particular attention to students when using VISIR for the first time - students may experience some difficulties in the beginning, so they need time with the teacher and/or tutorials

- The results support the assumption that the use of several resources (VISIR, simulation, calculus) improves students' performance, helping them to develop higher order skills, such as critical analysis
 - Group 1 students achieved better grades in all tasks/tests
 - All the 8 students identified as achieving higher order skills belong to Group 1
- Still the use of VISIR requires time spent with students, in class, explaining and exploring its functionalities

The results indicate that students clearly benefit from the usage of several resources, being more motivated and achieving better results. In this case of a math course, this brought important contextualization of the theoretical approaches, which may have helped students to see its pertinence.



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Thank you for your attention

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