

## STUDY OF MACHINE DYNAMICS PHENOMENA WITH JAVA APPLETS

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### **Abstract:**

*The work presents a modern instrument for learning and understanding physical phenomena, implicit special phenomena which appears in the study of "Machine dynamics", using Java applets. This kind of programs is preferred, because Java is free, is good supported by various browsers and is very flexible.*

### **Keywords:**

*Java, applets, machine dynamics, learning tools*

### **1. INTRODUCTION**

The Java language was developed at Sun Microsystems in December 1990 as part of the Green project, a small research effort into consumer electronics. Researchers were working on a programming language for smart appliances. The language was named Oak in honor of a tree Gosling could see out his office window. It was renamed in 1995 Java in honor of the lawyers who found out about another product called Oak and didn't want to go out on a limb. It was an inventive toy for the World Wide Web that had the potential to be much more. The word "potential" is an unusual compliment, because it comes with an expiration date. Sooner or later, potential must be realized or new words such as "letdown," "waste," and "major disappointment to your mother and I" are used in its place. Now in its fourth major release, Java appears to have lived up to the expectations that accompanied its arrival. More than two million people have learned the language and are using it in various domains. First used to create simple programs on World Wide Web pages, Java can be found today in a lot of, yesterday unusual, places. Java is now present in each of the following places and many more:

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- Web servers
- Relational databases
- Mainframe computers
- Telephones
- Orbiting telescopes
- Personal digital assistants
- Credit card-sized "smartcards"

An interesting field of appliance is the educational system. This because Java is:

- small - Programs load reasonably quickly on a Web page
- secure - Safeguards protect against programs that cause damage, whether accidental or intentional
- portable - Owners of Windows, Macintosh, Linux, and other operating systems can run the same program in their Web browsers without modification
- free - ...

Java is an object oriented programming language. He creates two kinds of programs: applications and applets. An applet is a piece of software code that runs under the control of a web browser, as distinct from the application which requires an interpreter. Applets are commonly used to enhance the interactivity of a web page, and deliver client-side content. Applets run in their own frame, and can display graphics, accept input from GUI components, and even open network connections. Due the potential security risks associated with running applets from external and potentially malicious sources, most web browsers limit file access, and impose additional restrictions on applets.

## 2. STUDY OF MACHINE DYNAMICS WITH JAVA SUPPORT

The study of physical phenomena, mechanics make not a difference, request good and divers laboratory equipment. It is very hard or not possible to have this in all our schools or universities. So Java applets can successful substitute the laboratory equipment, or to complete it.

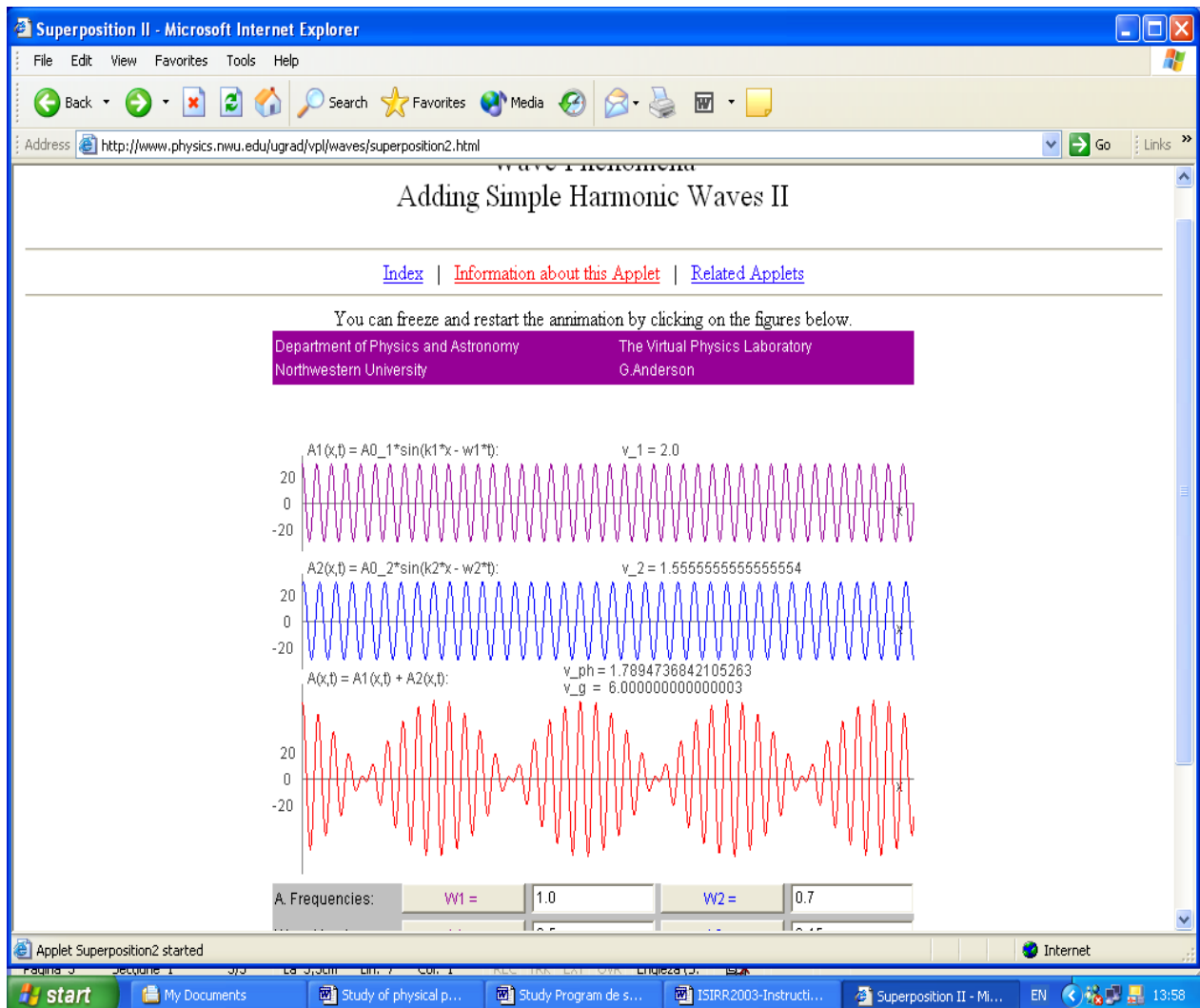
In my experience in teaching Machine dynamics I use to work with applets. Located in html files in a browser like Internet explorer it has the advantage to combine the possibilities of both. This are: the capability to present hypertext with the theoretical presentation, the possibility to link the student to appropriate or similar pages, the interactivity and visualization. So, introducing new dates the student can observe the influence in the system, he/she can call information about the subject from other places (internet or local network), can print the results and so on.

Next is presented an example linked to wave superposition, an important phenomena in Machine dynamics. The applet can be used to illustrate phenomena in both dispersive and non-dispersive media. For non-dispersive media, the user must enforce

$$|w_1/k_1| = |w_2/k_2| \quad (1)$$

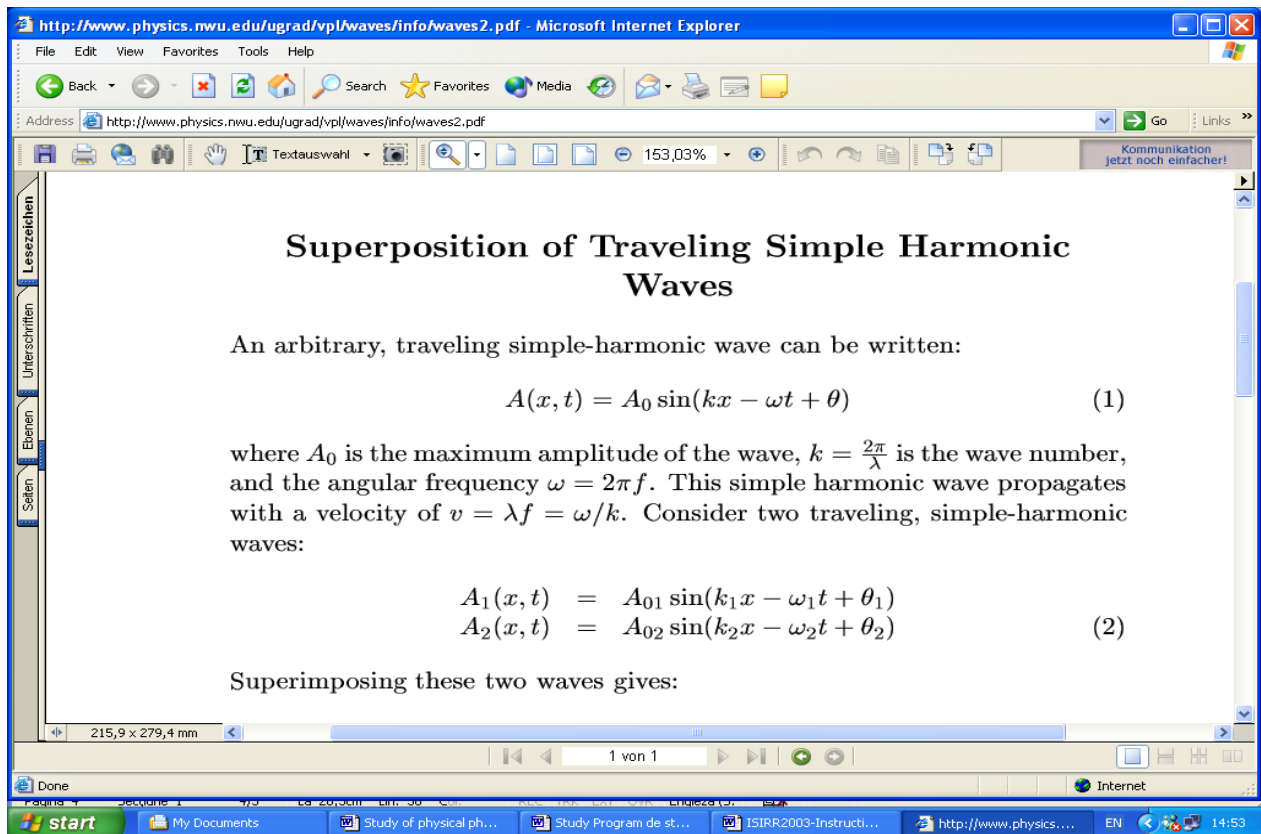
when specifying input values.

In the laboratory the student opens the html site and can see the following image (*Fig 1*).

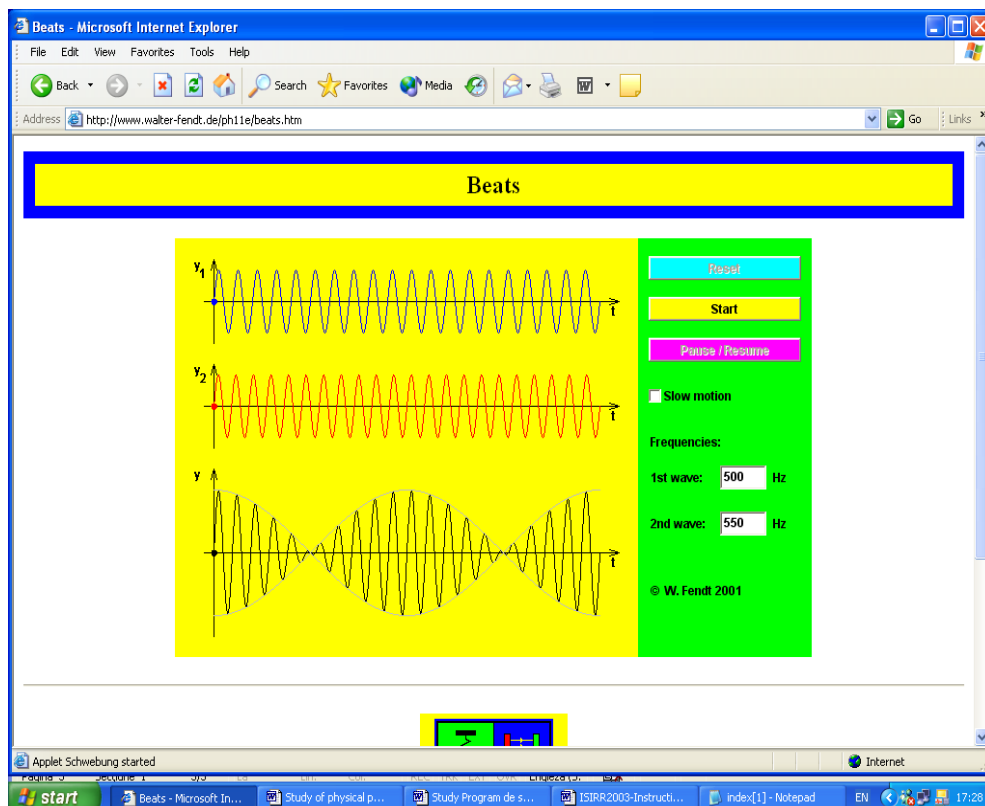


*Fig. 1 Adding simple harmonic waves*

The student can see what happens in case of wave superposition. Now, he/she can look in the theoretical background of the problem with a simple link. A dvi., postscript or pdf document is available. In the new window appears *Fig. 2*. for the pdf version. This permit a revue of the in courses learned elements, useful to understand the illustrated phenomena. With help of theoretical knowledge the students calculate the new waves equation, and then compare it with the applets result. Parameters of the both waves (amplitudes, frequencies and phases) can be modified.



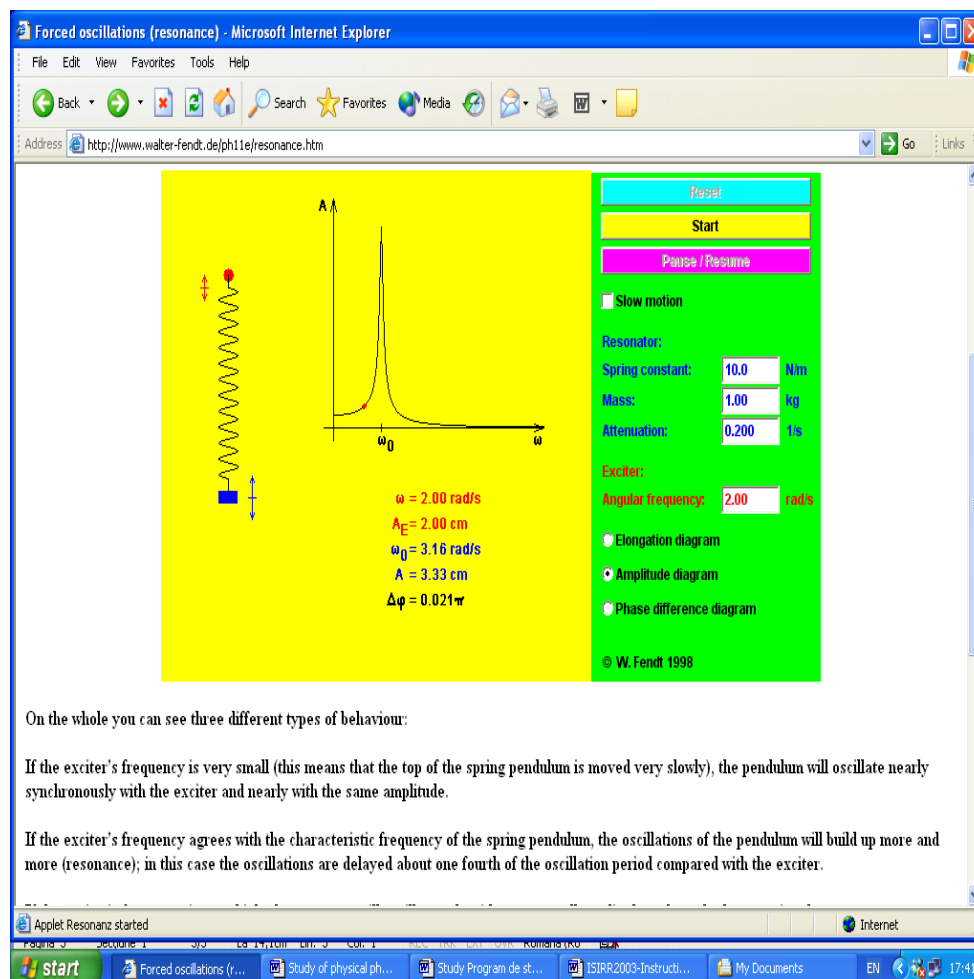
*Fig. 2 Theoretical background of the applet*



*Fig. 3 Beats phenomena modeled with Java applet*

It can be evidenced a various number of phenomena, like beats, resonance or amplitude modulation.

Examples of applets are presented in the following pictures, where beats (*Fig. 3*) and resonance (*Fig. 4*) are studied.



*Fig. 4 Resonance phenomena modeled with Java applet*

In these two applets the students can change the entering parameters - like frequency, mass, spring constant, attenuation - and so they can see the transformation in the studied system. The programs allow also designing diagrams for elongation, amplitude and phasing difference.

### 3. CONCLUSIONS

Java is a simple object orientated language, useful in educational process; it allows a lot of application. The dimension, high security, portability and in special because it's free make Java an interesting tool for teachers in the teaching process. Students like to work with applets because the interactivity transforms the educational process in a game. So, Java is a kindly tool more and more used in education.

#### 4. BIBLIOGRAPHY

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