The Net Advance of Physics: Website at MIT

FAST FOURIER TRANSFORM

Forum Articles: FAST FOURIER TRANSFORM

- General Definitions:
  - Fast Fourier Transform (Wikipedia)
  - Fast Fourier Transform (Eric Weisstein's MathWorld)
  - Fast Fourier Transform (Wikipedia)

- General Introductory:
  - The Fast Fourier Transform (Eric Weisstein's MathWorld)
  - The FFT Algorithm Technology Inf by Barry Cooper (IEEE News 20, No. 3, 1995)

- General:
  - The Fast Fourier Transform for Digital Signal Processing by Steven W. Smith (Steven Smith's Scientist and Engineer's Data Sheets)
  - Fast Fourier Transform by Ronald D. Crone (California Technical Publishing)
  - Computational algorithms for the Fast Fourier Transform by Ronald D. Crone (California Technical Publishing)
  - Cooley-Tukey Algorithm

- Fourier-series approx.
The first laser
Charles H. Townes
from A Century of Nature: Twenty-One Discoveries that Changed Science and the World
Laura Garwin and Tim Lincoln, editors

When the first working laser was reported in 1960, it was described as "a relation looking for a problem." But before long the laser's disruptive qualities—its ability to generate an intense, very narrow beam of light of a single wavelength—were being harnessed by science, technology, and medicine. Today, lasers are everywhere—from research laboratories at the cutting edge of quantum physics to medical clinics, superhero-like facelifts, and the remote control units.

Townes’s quote that appears later in the article

Townes’s quote is as short, as terse as many powerful communications, and I believe it might be considered the most important word of any of the articles that appeared on the cover of the most recent edition of Nature.

Therefore, Marianne built the first (only) laser, based on theory from a paper by Townes and Schawlow. I first heard of the following from Art Schawlow, who sensed that the first laser could be turned into a device for means of communication...
Science Education in the 21st Century (2008)

Editors: Nigel H. Sweller

Book Description

This is hardly another field in education which is more important for a country future than science education. Yet access and some obstacles prevent most students to appreciate in science the basis of making a medicine, the perception of disease, difficulty, in the actual degree of difficulty, 5. the lack of personal prestige and manage uncombined with the field, 6. the death of productivity to use tools, 7. the lack of personal knowledge and the limitations of science and limiting effective execution of these inside society.

Especially true for physics of laws

Chapter 8: Old Physics Books and Science Education (pp. 348)
Authors: Millennia/ Albert Einstein and Morton Quinionez

Chapter 9: Building Old Projects with New Technologies (pp. 369)
Authors: Millennia/ Albert D. Peters
The Pendulum: Scientific, Historical, Philosophical and Educational Perspectives (Google eBook)

Introduction

MICHAEL R. MATTHEWS, COLIN GAELD and ARTHUR STINTEN / The Pendulum: Its Place in Science, Culture and Philosophy

Scientific Perspectives

RANDALL D. PETERS / The Pendulum in the 21st Century Role as Trendsetter

RONALD NEWBURY / The Pendulum: A Paradigm for the Linear Oscillator

KLUMS WELTMER, ANTONIO SERGIO C. ESPIRITU, ROBERTO FERNANDES SILVA ANDRAGA and PAULO MIRANDA / Introduction to the Treatment of Non-Linear Effects Using a Geometrical Pendulum

CÉSAR MEDINA, SABRINA VELAZCO and JULIO SALINAS / Experimental Control of a Simple Pendulum Model

RANDALL D. PETERS / Some-Use Pendulum

NORMAN PHILLIPS / What Makes the French Pendulum Move Among the Stars?

Like several other book chapters by Peters, these were made possible because of his decision 15 years ago to engage seriously in open access publishing
Like other book chapters by Peters, these resulted in part from the decision to do open access publishing.
smartphone physics


iPhone 4S: See what's new - It's the most amazing iPhone yet.

Science & Technology

The papers noted above resulted in an interview with Prieto that appeared in the Aug 2011 issue of "Physics Today".

m-Science

For more information about this book visit www.m-science.net

Editors: Enrique Caceres and Mario Zenarri

Publisher:
ICTP - The Abdus Salam International Centre for Theoretical Physics

2010 ICTP Science Dissemination Unit, email: edu@ictp.it

Devoted to "Supporting Science in the Developing World"

The Nobel Prize in Physics

1978 Nobel Prize in Physics

In 1978, he was awarded the Nobel Prize in physics for his work on the theory of the diffusion of light in a random lattice, or in a path that was largely ...
Tidal Force Asymmetry

This model allows the initial term of the tidal field to play the first order of a Taylor series expansion. This treatment offers the initial term on the gravitational...

This article, listed as the first entry of the first page of the indicated 11,349,000 sites catalogued by Google, was unanswerable in June.

Our partnership with the physics students made it very special.

Will the students be eventually embarrassed by their action? (They will not)
Abstract:
The organization of structures at the mesoscale is assumed to be the real important mechanism for the stability of collagen fibrils. Evidence is presented for the hypothesis that self-organizational is fundamental to both biological and artificial systems. This article is a direct consequence of "networking"—doing research with "talks you come to know who can be equally important as what you know". As soon as other "slides" of this presentation, open access is a great facilitator for forming significant relationships. The purchase price of $20.00 for this Contemporary Physics article is "part of what's wrong" with publications other than open access.
A torque magnetometer for thin films applications

J. Pires, D. Oliveira, M. Carvalho, M. Cavaleiro

Department of Physics, University of Minho, 4800-058 Guimarães, Portugal

Received 6 September 2011; Revised 20 November 2011; Accepted 8 December 2011.

Abstract

We describe the development of an alternative torque magnetometer based on a torque pendulum. The instrument uses the superconducting sensor developed by D. Pires, M. Carvalho, M. Cavaleiro, et al. (2011) [1]. This sensor has a sensitivity of 1.7 × 10⁻⁷ J/m² and is capable of detecting magnetic anisotropy values as small as 1 nm. The instrument design and the measurement procedures are presented.

Another example of the need for more open access publishing. The article cited in the abstract was published two years before 1989. Due to the lack of any references, this paper should be cited and the author should be credited with the work that has been questioned by the reader.

In a later example of the same sort, editor Tom Holley did question the importance of U.S. research and wound up deciding one of his papers to the venerable British physicist B. V. Jones, who reviewed the work that was based on my 2nd patent.
Prediction of catastrophes: an experimental model

Randall D. Peters1, Martine Le Breton2 and Yves Pomeau 3
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2 Laboratoire de Physique des Solides, UMR 8501 CNRS, UPMC, Paris 6, France.
3 Department of Mathematics, University of Arizona, Tucson, USA.

Catastrophes of all kinds can be roughly defined as short duration-large amplitude events following and followed by long periods of "recovery". Major earthquakes surely belong to the class of "catastrophic" events. Because of the time-scale involved, an experimental approach is often difficult, not to say impossible, however desirable it could be. Described in this article is a "laboratory" setup which yields data of a type that is amenable to theoretical methods of prediction. Observations are made of a critical stretching down in the noisy signal of a solder wire creeping under constant stress. This effect is shown to be a fair signal of the forthcoming catastrophe in both of two dynamical models. The first is an "abnormal" model in which a time dependent quantity"... Thus, it seems that similar changes in the response to noise could forewarn catastrophes in other situations, where such precursor effects should manifest clearly enough.

PACS numbers: 05.45 a, 61.72 lb, 89.40 Bz, 89.40 Lm

Submitted also to Physical Review E, this paper would never have happened were it not for the article below, which was published only on the Mercer Physics webpage.

How long for Google to find our paper, and what 'ranking' (or visibility reasons)?
Some mathematical foundations in physics

The approximated graph appears to exist between the ways that mathematicians and physicists study chaos. A primary difference between these modeling methods can be shown to result from the choice of a tool for achieving agreement. In the integration of a system’s equations of motion, physicists generally prefer to describe a system in terms of its initial conditions and dynamic state. Mathematicians, on the other hand, prefer to use the complex plane in which the associated state set is bounded to construct a Mandelbrot set (Fig. 4) and its boundary is also chaotic. Details of the methodology are available in the text. (See also: Complex variables and complex numbers, Fractals)

From the "Chaos" section of McGraw-Hill’s Dictionary of Science and Technology

Randall D. Peters
Anharmonic oscillator

An oscillator that does not obey Hooke’s law. This law is a classical expression that assumes that a system subjected to a sinusoidal force will accelerate with a restoring force whose magnitude is proportional to the displacement. The use of Hooke’s law works well as a linear approximation of many systems that fail to describe many properties of the real world. Nature demonstrates two fundamentally different forms of nonlinearity, which may be called anharmonicity and damping nonlinearity. To understand the difference, consider the case of a harmonic oscillator; it is necessary to understand the difference.

Atomic Interaction

In the classical formulation, the simplest case is the one-dimensional, the movement of the particles in the potential function V represents displacement away from the stable position of equilibrium that was established between competing forces of attraction and repulsion. For example, in the case of two atoms constrained against motion, the potential describing their interaction can be approximated by the asymmetric potential case in Fig. 1. It is not symmetric because of the Pauli exclusion principle, involving the overlap of electronic orbitals. Thus, it is more difficult to reach the atoms together than it is to pull them apart. Therefore, the potential rises more quickly by comparison than it does for the electron. See also exclusion principle, internuclear force, molecular structure and spectra.

The Compton scale of energy, being the resonance value of 1 x 10^10 J, is thought to regulate, through self-regulating mechanisms, the processes “still unknown from first principles” responsible for internal friction. It is possible that one of the best thanks of physics actually lies in one of the most accessible parts of our world.
Interdisciplinary research (such as the $351,000 NSF grant responsible for this article) has been a spin-off consequence of open-access publishing.
For the nonlinear relationship shown here, plot the applied force $F$ versus the string displacement $x$ over the range $x = 0$ to $x = 6$. What is the $x$ value at which the force peaks at $F$ occurs? What are the advantages of drawing the force acting at a somewhat larger $x$ than this value before releasing it?

Solution: The applied force versus string displacement for a nonlinear relationship is shown in Figure 6.20.

Figure 6.20: Applied force versus displacement for a nonlinear relationship.

The force peaks at $F$ occurs for a slightly larger than $x = 6$. A more precise value is obtained by differentiating $F$ with respect to $x$, via:

$$\frac{dF}{dx} = -1400 \times 1^3 - 1380 \times 2 + 9725 = 0$$

This paper was not accepted by the American Journal of Physics.
bibliographia horologiae mundi
:: bhm simple search

Titles written by Randall Peters:

- Randall Peters
  - Title: Appendices with adjustable trends in the period
    - KEYWORDS: pendulum, acoustics
    - Parent Document ID: 27165
    - Parent Document Title: American Journal of Physics
    - Edition: 2003 07 16
    - Page: 1026 (2106 - 2107)
    - BHM No: 0522

- Randall Peters
  - Title: Author pendulum theoretical considerations
    - Other keywords: inter pendulum
    - Page or chapter: 10
    - BHM No: 0522
Ruchhardt Oscillator Decay - Thermodynamic basis for Hysteretic Damping

Author: [Name]

Subject: physics - electrical engineering - physics - science education

Download: [URL]

The Ruchhardt oscillator is a decades-old classic experiment. The novel thermodynamic analysis of this article would not have happened without the influence of Mentor students, along with the paper's energetic relationship to damping studies brought to a place of maturity easily because of the unique advantages of open access publishing.
They have listed virtually every article published by Peraza in "Handbook" (peer-reviewed) journals.

Note that the open access public items are included in the list.
Anisotropic Internal Friction Damping

Abstract

The mechanical damping properties of shear polycrystalline materials have been studied with a special pendulum. The polished samples were pressed under the four edges of the pendulum, which was operated at low-speed and point at the density of 1/2. With the edges oriented parallel to the direction of the long granular axis of the polycrystal, it was found that the damping was more than 10% smaller than when the edges were oriented parallel to the axis.

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Mendeley
Vibration-Based Fault Diagnosis of Hydraulic Pump of Tractor Steering System by Using Energy Technique

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Abstract
A novel vibration-based fault diagnosis technique is proposed for the hydraulic pump of a tractor steering system. The technique is based on the extraction of features from the vibration signals using energy analysis. The proposed method involves the extraction of energy parameters from the vibration signals and the subsequent classification of the pump operating conditions using a support vector machine (SVM) classifier. The effectiveness of the proposed method is validated using experimental data obtained from a hydraulic pump test rig. The results demonstrate the feasibility of using energy-based features for fault diagnosis in hydraulic pumps.

Keywords: Vibration; Energy; Fault Diagnosis; Hydraulic Pump; SVM Classifiers

Introduction
Hydraulic pumps are critical components of many agricultural machinery systems, such as tractor steering systems. Fault detection in hydraulic pumps is essential to ensure the safe and efficient operation of these systems. In this study, a new vibration-based fault diagnosis technique is proposed for the hydraulic pump of a tractor steering system. The technique is based on the extraction of features from the vibration signals using energy analysis.

Methodology
The proposed method involves the extraction of energy parameters from the vibration signals and the subsequent classification of the pump operating conditions using a support vector machine (SVM) classifier. The energy parameters are calculated using the fast Fourier transform (FFT) and the energy content of the vibration signals is calculated using the Hilbert transform. The SVM classifier is then used to classify the pump operating conditions based on the extracted energy parameters.

Results
The proposed method was validated using experimental data obtained from a hydraulic pump test rig. The results demonstrate the feasibility of using energy-based features for fault diagnosis in hydraulic pumps. The classification accuracy of the SVM classifier was found to be 95%, with a sensitivity of 92% and a specificity of 98%.

Conclusion
The proposed vibration-based fault diagnosis technique is an effective method for detecting faults in hydraulic pumps. The technique is based on the extraction of energy parameters from the vibration signals and the subsequent classification of the pump operating conditions using an SVM classifier. The results demonstrate the feasibility of using energy-based features for fault diagnosis in hydraulic pumps.

References

Figures
Figure 1: Vibration-based fault diagnosis of hydraulic pump using SVM classifier. The classification accuracy of the SVM classifier was found to be 95%, with a sensitivity of 92% and a specificity of 98%.

Figure 2: Energy content of vibration signals. The energy content of the vibration signals is calculated using the Hilbert transform.

Figure 3: SVM classifier for fault diagnosis of hydraulic pump.
Only place that high visibility article was submitted to was open access publication. Rejected manuscript, peer-review publication would have been problematic.
Study of quality factor and hysteresis associated with the state-of-the-art passive seismic isolation system for Gravitational Wave Interferometric Detectors

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Received 30 May 2004; Revised 8 July 2004; Accepted 13 August 2004

The figure from the paper shows the Q-factor versus resonant frequency. The relationship between these two parameters is described by a second-order polynomial:

\[ Q = \left( \frac{1}{f} \right)^2 \eta , \]

where \( f \) is the resonant frequency in Hz, \( \eta \) is a constant, and \( \eta \approx 10^{-3} \). At 13 Hz, the Q-factor is essentially critically damped. The fit suggests that the loss factor, \( \eta \), is of order \( 10^{-3} \).

After being shown as a referee to remove the article, I asked the editor if removing the basis for the selection of this "because of its apparent usefulness."

The figure from the paper shows a typical dependence of the quality factor on frequency. The quadratic dependence on frequency of the quality factor is consistent with the classical nonlinear theory of damping that I developed several years earlier, and which is also described in the Contemporary Physics article titled "Damping in the materials."