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2010 : May - New Hot Papers : Juan J. Nieto & Donal O'Regan Discuss Linear and Nonlinear Functional Analysis

**new hot papers - 2010**

May 2010



**Juan J. Nieto & Donal O'Regan talk with ScienceWatch.com and answer a few questions about this month's New Hot Papers in the field of Mathematics.**



*Juan J. Nieto with Peter D. Lax, Professor Emeritus of Mathematics at the Courant Institute of Mathematical Sciences at New York University.*

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**Article Title: Variational approach to impulsive differential equations**

Authors: **Nieto, JJ;O'Regan, D**

Journal: NONLINEAR ANAL-REAL WORLD APP

Volume: 10

Issue: 2

Page: 680-690

Year: APR 2009

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**SW: Why do you think your paper is highly cited?**

The paper combines both linear and nonlinear functional analysis. In particular, we use the celebrated Lax-Milgram theorem with critical point theory and the theory of impulsive dynamical systems. See photo of Peter D. Lax pictured above with Juan. J. Nietro.

The paper shows that the solution for some discontinuous or impulsive differential equations is given by minimizing an action functional associated with the system.

Although the ideas in the paper are simple, they can be applied in a variety of situations to the study of theoretical and applied problems.

Some of the authors citing our paper examine new problems using our methodology.

**SW: Does it describe a new discovery, methodology, or synthesis**

## of knowledge?

We combined different settings to present a new approach to the study of dynamical systems having an impulsive, dynamical behavior. It permits us to consider discontinuous phenomena, which is difficult using classical tools. In particular, we reveal the variational structure underlying some impulsive differential equations.



Coauthor Donal O'Regan

## Would you summarize the significance of your paper in layman's terms?

Our paper uses the classical theory of functional analysis to show how simply one can examine dynamical systems with discontinuous phenomena which arise in real-life applications. In a sense, it unifies and harmonizes both linear and nonlinear theory.

## How did you become involved in this research, and were there any problems along the way?

### Where do you see your research leading in the future?

Functional analysis is one of the great contributions of mathematics in the 20th century and the Lax-Milgram theorem is one of the cornerstones in the study of nonlinear partial differential equations.

We both work in the area of nonlinear functional analysis. Over the years we've had a special interest in the theory of discontinuous differential equations which arise in real-world applications. In our paper we fused both themes to obtain a new approach to the examination of impulsive differential equations.

We feel our future research will continue to promote classical analysis in the study of real-world applications. Research in mathematics usually has some unexpected implications for the future and is really quite hard to predict, but we are hopeful.

## Professor Juan J. Nieto

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KEYWORDS: IMPULSIVE ORDINARY DIFFERENTIAL EQUATIONS; LAX-MILGRAM THEOREM; CRITICAL POINTS; MOUNTAIN PASS THEOREM; DIRICHLET BOUNDARY CONDITIONS; BOUNDARY-VALUE-PROBLEMS; GLOBAL ATTRACTIVITY; PULSE VACCINATION; LINEAR-EQUATIONS; EPIDEMIC MODEL; SYSTEMS; POPULATION; DYNAMICS.



