11th Pan-American Congress of Applied Mechanics

PACAM XI

Nature and Technology side-by-side

Foz do Iguaçu, PR, Brazil

January 4 - 8, 2010

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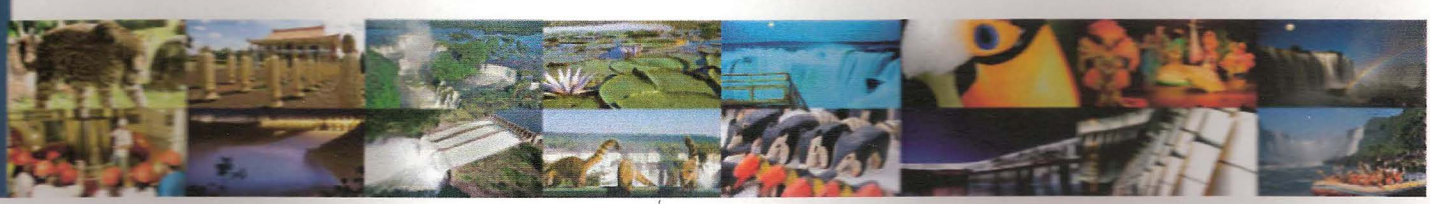

PACAM XI

ELEVENTH PAN-AMERICAN CONGRESS OF APPLIED MECHANICS

BOOK OF ABSTRACTS

REVISED EDITION

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Book of Abstracts

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BRAZILIAN SOCIETY FOR APPLIED AND COMPUTATIONAL MATHEMATICS - SBMAC

January 2010, Foz do Iguaçu, PR, Brazil

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Brazilian Society
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and Computational Mathematics

January 2010, Foz do Iguaçu, PR, Brazil

WELCOME AND FOREWORD MESSAGE

Welcome to Foz do Iguaçu. Enjoy your time in this cosmopolitan city at the border of Brazil, Argentina, and Paraguay. The city attracts visitors from around the world for its natural and technological wonders. It is the place of both the third largest waterfall in the world, the Iguassu Falls, and the world´s largest hydroelectric plant in power output, the Itaipu Binacional (IB). Also, according to the American Society of Civil Engineers (ASCE), the Itaipu Dam is one of the Seven Wonders of the Modern World. We have planned technical visits to the Itaipu Dam during the period of the event.

The aim of the Pan-American Congress of Applied Mechanics (PACAM) series is to promote progress in the broad field of Mechanics by (1) exposing engineers and scientists, as well as advanced graduate students, to new research developments, methods, and problems in Mechanics, and (2) providing broad opportunities for personal interactions through means of formal presentations and informal conversations.

The Pan-American Congress of Applied Mechanics (PACAM) is held every two years, always in a Latin American venue, at a time when few other conferences are scheduled. The previous congresses are listed below.

In PACAM XI we have introduced the theme Nature and Technology side-by-side with the objective of calling the attention of all participants to Brazilian initiatives to promote technological development while preserving the natural resources. Some of these initiatives are sponsored by Itaipu Binational and consist of programs such as The Cultivating Good Water program. This program seeks to establish criteria and conditions to guide the company's social-environmental initiatives related to the conservation of natural resources. It is focused on the quality and quantity of water and on people's quality of life.

The PACAM XI program consists of concurrent sessions in the general areas and mini-symposia listed below. The mini-symposia are being organized by researchers from Europe and the Americas. Each session contains 20-minute talks, which are based on papers previously submitted and peer reviewed. The authors of these papers are originally from 36 countries of the Americas, Europe, Asia, and Africa. The abstracts of these papers are published here, in the Book of Abstracts, and the papers presented during the congress, which contain a maximum of six pages, will be published in the Proceedings of PACAM XI. These proceedings will be sent to the authors who presented the papers.

Best wishes to all PACAM XI participants. We hope for a successful and enjoyable meeting.

Adair R. Aguiar

Latin American Chair of PACAM XI

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GENERAL AREAS

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Abstract. *The exact bending solutions of moderately thick rectangular plates with two opposite sides simply supported are derived based on the symplectic geometry method. The basic equations for the plates are transferred into Hamilton canonical equations. Then the whole state variables are separated. According to the method of eigenfunction expansion in the symplectic geometry, the exact bending solutions of the plates are obtained. Since only the basic elasticity equations of the plates are used and there is no need to select the deformation functions arbitrarily, the approach utilized is completely reasonable.*

Keywords: *moderately thick plate, exact solution, symplectic approach*

PAC0240: THE DEFORMATION OF CYLINDRICAL SHELLS SUBJECTED TO RADIAL LOADS

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Abstract. *Cylindrical shells have a simple geometry and application in pressure vessels and piping engineering. Thedevelopment of calculation algorithms in structural project is impelled by a constant challenge in the search of moreaccurate and fast design tools in engineering. The objective of this work is to contribute with a simple and reliable numerical tool for the stress analysis of cylindrical vessels subjected to generalized forces. A hybrid formulation in the definition of forces and displacements is proposed for cylindrical shells subjected to radial loads. Variational techniques coupled with functional analysis are used to obtain an optimized solution for the shell displacement and further stress field evaluation. As it is not possible to obtain exact solutions for the displacements or deformation field whenever the external loads are either concentrate or locally distributed, the solution here proposed deals with the combination of unknown analytic functions combined with Fourier expansions, where the former depend on the axial shell coordinate and the trigonometric terms are dependent upon the cylinder circumferential polar angle. These functions are expanded in Fourier series where displacement amplitudes are combined with trigonometric terms. The result is a system of ordinary differential equations where the solution is analytic after evaluation of eigenvalues and eigenvectors. The boundary conditions are then used to reach the final solution. As an example a large cylindrical shell subjected to pinching loads is considered. The results for the radial displacement and section ovalization are analyzed where the solution was obtained with three terms (n_θ=6) for the accuracy is acceptable in this case. The transverse displacement presents important dependence on the shell thickness vs radius, as the shell can be a thin-walled one (this case is included in the presented example) up to a moderately thick one, where the surface displacement ranges until the extreme edges, which is not the case analyzed. The proposed method leads to accurate results with a relatively low complexity input data. For conclusions of this work it is remarked that the definitions of the load system and boundary conditions are easily processed as the method has pre-defined possibilities for each load case or edge boundary conditions. An analytic solution is obtained and a low number of terms in the Fourier series show good accuracy. A comparison with finite element methods is presented.*

Keywords: *piping engineering, Fourier series, system of differential equations, boundary conditions*