

# WWlet: WAVELETS & APPLICATIONS

Numerical Methods for PDEs and Signal Processing

Last update: São José dos Campos, January, 5 2017

The Organizing Committee of WWlet is pleased to invite you to participate in the event Wavelet Applications in Numerical Methods for PDEs and Signal Processing to be held in São José dos Campos, SP, Brazil.

In the last few decades wavelets techniques have become an important research area in numerical analysis and an important tool in modern signal processing. Wavelets applied to the solution of partial differential equations can provide an alternative tool for developing adaptive methods, which enable an adaptive refinement of the solution according to its local regularity. One of the main goals of this event is to explore concepts of wavelet analysis and its theoretical, numerical and computational aspects applied to the field of partial differential equations and signal processing. This special event is dedicate to aerospace applications.

We also have been organizing a regular scientific group activity in São José dos Campos, SP with CNPq and FAPESP financial support. Please contact [wwlet@inpe.br](mailto:wwlet@inpe.br) for more information. Material from the events are available in INPE library. Software are avaible at github.

## 1 Main activities in 2016:

### Regular seminars in Wavelet Applied to Space Physics (WASP), INPE

Organizers:

1. Margarete Oliveira Domingues (LAC/CTE/INPE)
2. Odim Mendes (DGE/CEA/INPE)
3. Renato Branco (DIR/INPE)

**Short-Course: Block-Structured Adaptive Mesh Refinement in C++ The AMROC Framework for Parallel AMR** by Dr. Ralf Deiterding, University of Southampton 30th of June and 1st of July 2016, São José dos Campos, São Paulo, Brazil.

Financial support: FAPESP-Newton Fund and British Council (grants 2015/50403-0 and 2015/25624-2).

Organizers:

1. Celso Mendes (LAC/CTE/INPE)
2. Margarete Oliveira Domingues (LAC/CTE/INPE)
3. Odim Mendes (DGE/CEA/INPE)
4. Renato Branco (DIR/INPE)

## **2 Main activities in 2015:**

**Regular seminars in Wavelet Applied to Space Physics (WASP), INPE**

Organizers:

1. Anna Karina Fontes Gomes (CAP/CTE/INPE)
2. Margarete Oliveira Domingues (LAC/CTE/INPE)
3. Odim Mendes (DGE/CEA/INPE)
4. Renato Branco (DIR/INPE)

### **Activities in DINCON, Natal**

1. Mini-course: Continuous Wavelet transform, by Margarete Domingues, and Odim Mendes
2. Technical section in Wavelets and Applications

## **3 Main activities in 2014:**

**Regular seminars in Wavelet Applied to Space, INPE**

Organizers:

1. Margarete Oliveira Domingues  
Laboratório Associado de Computação e Matemática Aplicada - LAC  
Coordenação dos Laboratórios Associados - CTE
2. Anna Karina Fontes Gomes  
Laboratório Associado de Computação e Matemática Aplicada - LAC  
Coordenação dos Laboratórios Associados - CTE
3. Odim Mendes Divisão de Geofísica Espacial - DGE  
Coordenação Geral de Ciências Espaciais e Atmosféricas - CEA

## **4 Main activities in 2013:**

**VII WWlet in DINCON, Fortaleza, Ceará**

Organizers:

1. Eniuce Menezes de Souza  
Universidade Estadual de Maringá
2. Margarete Oliveira Domingues  
Laboratório Associado de Computação e Matemática Aplicada - LAC  
Coordenação dos Laboratórios Associados - CTE Instituto Nacional de Pesquisas Espaciais - INPE

### **Technical sections**

### **Thematic group meeting**

## 5 Main activities in 2012:

### VI WWlet in CNMAC, INPE

- 17-21th Sep., XXXIV CNMAC, Águas de Lindóia, São Paulo
- 24th Sep., INPE, Cachoeira Paulista, São Paulo
- 24-27th Sep., INPE, São José dos Campos, São Paulo

Organizers:

1. José Eduardo Castilho  
Faculdade UnB de Planaltina - FUP Universidade de Brasília
2. Margarete Oliveira Domingues  
Laboratório Associado de Computação e Matemática Aplicada - LAC Coordenação dos Laboratórios Associados - CTE Instituto Nacional de Pesquisas Espaciais - INPE
3. Magda Kimico Kaibara  
Departamento de Matemática Aplicada - GMA Instituto de Matemática e Estatística - IME Universidade Federal Fluminense - UFF
4. Odim Mendes  
Divisão de Geofísica Espacial - DGE Coordenação de Ciências Espaciais e Atmosféricas - CEA Instituto Nacional de Pesquisas Espaciais - INPE
5. Aylton Pagamisse  
Universidade Estadual Paulista - UNESP - Presidente Prudente

### XXXVI CNMAC, 17-21 Sep. 2012, Minisymposium

1. Reconstruction of tokamak plasma light emission from single images by wavelet-vaguelette decomposition. Romain Nugyen van yen, Freie Universität, Germany
2. Wavelet analysis of intermittency in MHD turbulence. Marie Farge, ENS, Paris, France
3. Dual-Tree Wavelets and their application to Vision Systems - introducing wavelet-based keypoint detectors and robust keypoint descriptors with rotation invariant properties. Nick Kingsbury, Cambridge University
4. Dual-tree wavelet and new tecnicas to phase determination in control systems. Elbert Macau, INPE
5. A wavelet-based filtering of ensemble background-error variances. Olivier Pannekoucke, Meteo-France, France
6. Adaptive multiresolution or adaptive mesh refinement? Kai Schneider, Aix-Marseille University, France
7. Wavelets methods and applications to artificial satellite signals. Eniuce Menezes de Souza, Universidade Estadual de Maringá - PR
8. Multiscale methods to solve differencial equations in visual computation. Jorge Stolfi, IC/UNICAMP

## **Mini-course - 17-21th Sep.**

1. CNMAC/MC4 - INTRODUÇÃO AO MUNDO DAS WAVELETS, José Eduardo Castilho (UnB), Margarete Domingues (INPE), Odim Mendes (INPE), Aylton Pagamisse (UNESP-Pres. Prudente)
2. CNMAC - Complex-valued wavelets, the dual tree, and Hilbert pairs: why these lead to shift invariance and directional m-D wavelets? (3,5 hours), Nick Kingsbury, Cambridge University

## **Technical sections in CNMAC**

### **Satellite events: INPE, UFF, UFRJ, UNICAMP**

1. 10-27th Sep. Mini-courses and seminars:
  - UFF - Dual-Tree Complex Wavelets - their key properties and a range of image-processing applications Nick Kingsbury, Cambridge University
2. IC-UFF 12 Sep.
3. UFRJ - D'Alembert's paradox and the resistance of fluid flows in the fully-developed turbulent regime: still an open problem Marie Farge, ENS, Paris, France
4. INPE - How wavelets are used to study turbulent transport in fluid and plasma flows Marie Farge, ENS, Paris, France Kai Schneider, Aix-Marseille University, France Romain Nugyen van yen, Freie Universität, Germany
5. INPE - A wavelet-based filtering of ensemble background-error variances. Olivier Pannekoucke, Meteo-France, France
6. INPE, CP, 24 Sep.

## **6 Main activities in 2011:**

**V WWlet in DINCON, Águas de Lindoia, São Paulo**   Organizers:

1. Margarete Oliveira Domingues

Laboratório Associado de Computação e Matemática Aplicada - LAC Coordenação dos Laboratórios Associados - CTE Instituto Nacional de Pesquisas Espaciais - INPE

2. Odim Mendes

Divisão de Geofísica Espacial - DGE Coordenação de Ciências Espaciais e Atmosféricas - CEA Instituto Nacional de Pesquisas Espaciais - INPE

3. Aylton Pagamisse

Universidade Estadual Paulista - UNESP - Presidente Prudente

**Minisymposium 6 Program: August 29** Open section: José Castilho, Margarete Domingues, Odim Mendes, Aylton Pagamisse

1. TRANSFORMADA WAVELET E SUPER-RESOLUÇÃO DE IMAGENS, Aylton Pagamisse, Marco Antonio Piteri
2. MULTISCALE ANALYSIS OF GEOMAGNETIC DISTURBANCES: CASE STUDY IN SOUTH ATLANTIC ANOMALY REGION, Odim Mendes, Marize Correa Simões, Margarete Oliveira Domingues, Varlei E. Menconi
3. WAVELET MEYER COMO REGULARIZADORA DE EQUAÇÕES TIPO CAUCHY-POISSON DE INTERESSE DA FÍSICA DE PLASMA ESPACIAL, Margarete Domingues, Magda Kaibara, Odim Mendes

**Minisymposium 6 Program: August 30**

1. ESQUEMA LIFTING-WAVELET INTERPOLADOR PARA EQUAÇÕES DIFERENCIAIS PARCIAIS, José Castilho
2. DETECÇÃO DA SINCRONIZAÇÃO DE FASE ENTRE SISTEMAS COM DINÂMICA CAÓTICA EMPREGANDO A TRANSFORMADA WAVELET COMPLEXA DUAL-TREE, Maria Teodora Ferreira, Elbert E. N. Macau 1, Rosângela Follmann Bageston, Margarete Oliveira Domingues

**Other Activities:**

1. Discussion on a proposal to a thematic group in SBMAC (DISCUSSÕES SOBRE PROPOSTAS DE UM GRUPO TEMÁTICO)  
Coordinators: José Castilho, Margarete Domingues
2. Presentation of master and PhD proposals (APRESENTAÇÃO DE PROPOSTAS DE PROJETOS DE MESTRADO E DOUTORADO EM ANDAMENTO)  
Coordinators: Aylton Pagamisse, Magda Kaibara, Odim Mendes

**Financial support** CAPES, CNPq, FAPESP

## **7 Main activities in 2010:**

**IV WWLET, in DINCON,** Serra Negra, SP, Brazil on June 7th to 11th

Organizers:

1. Margarete Oliveira Domingues  
Laboratório Associado de Computação e Matemática Aplicada - LAC Coordenação dos Laboratórios Associados - CTE Instituto Nacional de Pesquisas Espaciais - INPE
2. Magda Kimico Kaibara  
Departamento de Matemática Aplicada - GMA Instituto de Matemática e Estatística - IME Universidade Federal Fluminense - UFF
3. Odim Mendes  
Divisão de Geofísica Espacial - DGE Coordenação de Ciências Espaciais e Atmosféricas - CEA Instituto Nacional de Pesquisas Espaciais - INPE

## **INPE, June 02nd - 06th**

1. Working Group : Wavelet applied to MHD-turbulence, Margarete Oliveira Domingues, Peter Frick, Magda Kaibara, Odim Mendes
2. Working Group : Wavelet applied to Quasar dataset, Dr. Luis Botti, Margarete Oliveira Domingues, Peter Frick, José Soto

## **Serra Negra, Dincon, June 07 - 11**

1. Working Group : Wavelet applied to Geomagnetic analysis, Margarete Oliveira Domingues, Peter Frick, Odim Mendes, Virginia Klausner
2. Working Group : Wavelet applied to solar physics, Guillermo Adrián Stenborg, Alisson Dal Lago

## **Short course - June 11th**

1. Shell models - a dynamical systems approach to fully developed turbulence, Dr. Peter Frick, Institute of Continuous Media Mechanics of Ural, Branch of the Russian Academy of Sciences, Perm, Russia

**Minisymposium 6 - June 11th** Open section of MS: Margarete Oliveira Domingues, Magda Kimico Kaibara, Odim Mendes.

1. On the use of Harmonic Wavelets for the solution of some PDE's and an application to a precipitation front propagation model, Saulo R. M. Barros, Pedro da Silva Peixoto, Universidade de São Paulo, São Paulo, Brazil
2. Wavelet based Faraday Rotation Measure Synthesis, Peter Frick, Rodion Stepanov Institute of Continuos Media Mechanics of Ural, Branch of the Russian Academy of Sciences, Perm, Russia, Dmitry Sokoloff, Department of Physics, Moscow State University, Moscow, Russia
3. Wavelet analysis of bioimpedanometric data, Peter Frick, Rodion Stepanov, Institute of Continuos Media Mechanics of Ural, Branch of the Russian Academy of Sciences, Perm, Russia, Sergey Podtaev Department of Physics, Perm State University, Bukireva str. 15, Perm, 614990, Russia, Andrew Dumler, Perm State Medical Academy
4. Revealing Physical Process in Space Plasma Disturbances with Wavelet Analysis, Anthony T. Y. Lui, Johns Hopkins University (JHU/APL), Laurel, MD 20723-6099, USA
5. Application of multi-scale analyses on solar images from SOHO and STEREO, Guillermo Adrián Stenborg, Interferometrics, Inc., USA.
6. Image Analysis Based on Wavelet Transforms, Helio Pedrini Instituto de Computação, UNICAMP, Campinas, Brazil
7. Final Discussion and closing section of the MS 6, Margarete Oliveira Domingues, Magda Kimico Kaibara, Odim Mendes.

**Serra Negra and INPE, June 12th-13th** Working Group : Wavelet applied to reconnection problems. Margarete Domingues, Magda Kaibara, Anthony Lui, Odim Mendes, Arian Gonzalez

**Financial support** CAPES, CNPq, FAPESP

## 8 Main activities in 2009:

### III WWlet Organizers:

1. Margarete Oliveira Domingues

Laboratório Associado de Computação e Matemática Aplicada - LAC Centro de Tecnologia Espaciais  
Instituto Nacional de Pesquisas Espaciais - INPE

2. Magda Kimico Kaibara

Departamento de Matemática Faculdade de Ciências - FC Universidade Estadual Paulista - Unesp

3. Alice de Jesus Kozakevicius

Departamento de Matemática Centro de Ciências Naturais e Exatas - CCNE Universidade Federal de Santa Maria - UFSM

4. Odim Mendes

Divisão de Geofísica Espacial Instituto Nacional de Pesquisas Espaciais - INPE

5. Technical support: Thiago Pedro Donadon Homem

Pós-graduação Engenharia Elétrica Faculdade de Engenharia - FEB Universidade Estadual Paulista - Unesp

### Financial support Capes, CNPq, FAPESP

**Minisymposium - May 19, 2009** Open Section: Margarete O. Domingues, Magda K. Kaibara, Alice J. Kozakevicius and Odim Mendes Jr.

1. Double Wavelet Analysis - method for recognizing stellar activity peculiarities Peter Frick, Institute of Continuous Media Mechanics of the Ural Branch of the Russian Academy of Sciences, Perm, Russia.

2. Wavelets to compute turbulence: Burgers, Euler, Navier-Stockes Equations Marie Farge, Ecole Normale Supérieure, Paris, France.

3. Numerical simulations of the Stefan problem using wavelets Jacques Liandrat, Centrale Marseille, France

4. Detection of convective rolls using continuous wavelets transform Angela Leó Mecías, Facultad de Matemática y Computación, Havana, Cuba.

5. Error map technique in dyadic meshes Jorge Stolfi, Instituto de Computação, UNICAMP

6. Multiresolution and Adaptive Mesh Refinement schemes: a comparative study Ralf Deiterding, Margarete O. Domingues, Sônia M. Gomes, Olivier Roussel and Kai Schneider, Departamento de Matemática Aplicada, IMECC-UNICAMP

7. An adaptive multiresolution method for the Coherent Vortex Simulation (CVS) of compressible turbulent flows Olivier Roussel\* and Kai Schneider \*FAPESP Visiting researcher at Departamento de Matemática Aplicada, IMECC-UNICAMP

8. The use of Daubechies bases in Wavelet-Galerkin method Maria Tereza Martins and Victoria Vampa, Departamento de Matemática, Facultad de Ciencias Exactas, Universidad Nacional de La Plata, Argentina

**Roundtable:** Odim Mendes (Chair)

1. Wavelets in Wannier functions Alexys Bruno Alfonso Departamento de Matemática, Faculdade de Ciências, UNESP/Bauru
2. Improving the estimation of daily rainfall from NDVI using the wavelet transform Adolfo Nicolas Posadas Durand "Visiting researcher" at Embrapa Instrumentação Agropecuária, International Potato Center (CIP)
3. Image segmentation challenges and possible solutions with wavelets Rafael Santos Laboratório Associado de Computação e Matemática Aplicada, LAC/CTE/INPE
4. The wavelet transform applied to bifurcation in the dynamic population models Matheus Alvarez and José Raimundo de Souza Passos\* \*Departamento de Bioestatística, UNESP/Botucatu
5. Open discussions

**Financial support** CAPES, CNPq, FAPESP

## 9 Main activities in 2008:

**II WWlet, in CNMAC,** Belém/PA, Sep. 11th 2008, in 31th Congresso Nacional de Matemática Aplicada e Computacional

**Open section:** Alice de Jesus Kozakevicius, Magda Kimico Kaibara, Margarete Oliveira Domingues

1. SPARSE POINT REPRESENTATION TECHNIQUES WITH TIME STEP CONTROL, Sônia Maria Gomes, Andrielbe Oliveira, Anamaria Gomide, Margarete Oliveira Domingues, Paulo Jorge Gonçalves Ferreira, José Rocha Pereira, Pedro Renato Tavares Pinho.
2. APPLICATION OF PML ABSORBING BOUNDARIES IN THE SPR METHOD, Pedro Renato Tavares Pinho, Paulo Jorge Gonçalves Ferreira, José Rocha Pereira, Sônia Maria Gomes, Andrielber Oliveira, Anamaria Gomide, Margarete Domingues.
3. NUMERICAL SOLUTION OF HYPERBOLIC-ELLIPTIC SYSTEMS OF CONSERVATION LAWS BY MULTIRESOLUTION SCHEMES, Alice de Jesus Kozakevicius, Stefan Berres, Raimund Bürgers
4. ALGORITHMS ON ADAPTIVE DYNAMIC GRIDS, Jorge Stolfi
5. ADAPTIVE MULTIRESOLUTION METHODS FOR EVOLUTIVE PDES, Margarete Domingues, Sônia Maria Gomes, Olivier Roussel, Kai Schneider.
6. NUMERICAL METHODS FOR GENERALIZED KDV EQUATIONS, Mauricio Sepulveda Cortes, Octavio Vera Villagran.
7. DISCUSSIONS: Magda Kimico Kaibara (chair)

**Financial support** CAPES, CNPq, FAPESP

## 10 Main activities in 2007:

**I WWlet, in INPE** INPE, São José dos Campos, Brazil, from November 5th - 7th, 2007.  
Organizers:

1. Chou Sin Chan (CPTEC/INPE);
2. Elbert Macau (LAC/INPE);
3. Margarete Oliveira Domingues (LAC/INPE);
4. Odim Mendes (DGE/INPE);

Technical staff:

1. Maria Cristina Peloggia de Araújo (Secretary);
2. Marize Simões (Engineer);
3. Varlei Menconni (Enginner).

**Lectures:** Sônia Gomes (IMECC/Unicamp), Anamaria Gomide (IC/Unicamp), Alice Kozakevicius(UFSM)

**Technical discussions:** Sônia Gomes, Anamaria Gomide, Elbert Macau, Margarete Oliveira Domingues, Odim Mendes.

**Promotion:** INPE

**Co-sponsors** ApLBA, CAPES, CNPq

## Snapshots:

The image is a collage of several website screenshots for the 'WWlet' series of conferences, specifically the 'Wavelets & Applications' tracks. The websites are arranged in a grid-like fashion, each featuring a different year (2008, 2009, 2010, 2011, 2012) and a unique design. Each site includes the INPE logo, the conference title 'WWlet - Wavelets & Applications', and details about the event's location, dates, and organizing committee. The websites also feature various banners, logos for sponsors like 'BRASIL', and sections for 'Under Construction' or 'Home'. The overall theme is consistent across all sites, focusing on wavelet applications in numerical methods for PDEs and signal processing.