

**Book of Abstracts of
the XII International Conference on
Integral Methods in Science and Engineering
IMSE2012**

23rd – 27th of July 2012

**Dall' Onder Grande Hotel
Bento Gonçalves, RS, Brazil**

Contents

1	Sessions of the 23rd of July	8
1.1	Plenary Talk (15:30 – 16:30): Methods In Integral Neutron Transport	8
1.2	Seminars (17:00 – 18:30)	9
1.2.1	Session 01 (17:00 – 17:30): On the role of non-linear temperature feedback in Neutron point kinetics with precursors	9
1.2.2	Session 02 (17:30 – 18:00): Angular Reconstruction Of Monoenergetic Neutron Flux In Non-Multiplying Slabs Using Synthetic Diffusion Approximation	10
1.2.3	Session 03 (18:00 – 18:30): On The Convergence Of The Multigroup Isotropic Neutron LTS_N Nodal Solution In Cartesian Geometry	11
2	Sessions of the 24th of July	12
2.1	Plenary Talk (09:00 – 10:00): Turbulence Closure Problem: State Of The Art And Applications To Environmental Modelling	12
2.2	Seminars (10:30 – 12:30)	14
2.2.1	Session 04 (10:30 – 11:00): Operational Ionospheric Dynamics Prediction For South America	14
2.2.2	Session 05 (11:00 – 11:30): Atmospheric Temperature Profiles From The GPS Radio-Occultation Data By Neural Network	15
2.2.3	Session 06 (11:30 – 12:00): Data Mining To Identify Extreme Meteorological Events To The Brazil	16
2.2.4	Session 07 (12:00 – 12:30): A First Order Pertubative Analysis Of The Advection-Diffusion Equation For Pollutant Dispersion In The Atmospheric Boundary Layer	17
2.2.5	Session 08 (12:30 – 13:00): Transport Numerical Modelling Of Radionuclides In Surficial Waters	18
2.2.6	Session 09 (15:00 – 15:30): Numerical Solutions Of The 1d Convection-Diffusion-Reaction And Burgers Equations Using Implicit Multi-Stage And Finite Element Methods	20
2.2.7	Session 10 (15:30 – 16:00): Predictability For The Lorenz Chaotic System By Neuro-Fuzzy Approach	21
2.2.8	Session 11 (16:00 – 16:30): Automatic Configuration Of An Artificial Neural Network With Application To Data Assimilation	22
2.2.9	Session 12 (17:00 – 17:30): On A Simple Air-Water or Air-Soil Transfer Model For Pollutant Dispersion	23
2.2.10	Session 13 (17:30 – 18:00): Solving Boltzmann-Type Equations Using Differential Constraints	24
2.2.11	Session 14 (18:00 – 18:30): On Coherent Structures From A Diffusion Alike Model	25

3	Sessions of the 25th of July	26
3.1	Plenary Talk (09:00 – 10:00): What is Convergence Acceleration Anyway?	26
3.2	Seminars (10:30 – 13:00)	27
3.2.1	Session 15 (10:30 – 11:00): On Boundary Homogenization For Linear And Nonlinear Robin Type Boundary Conditions On Cavities	27
3.2.2	Session 16 (11:00 – 11:30): The Direct Method For Harmonic Oscillations Of Elastic Plates With Robin Boundary Conditions	28
3.2.3	Session 17 (11:30 – 12:00): On Homogenization Of Spectral Problems With Robin Type Boundary Conditions For Cavities Along Manifolds	29
3.2.4	Session 18 (12:00 – 12:30): Spectral Properties Of Boundary-Domain Integral Equations For Variable-Coefficient BVPs	30
3.2.5	Session 19 (12:30 – 13:00): Scale Invariance And Some Limits In Transport Phenomenology: On The Existence Of A Spontaneous Scale	31
4	Sessions of the 26th of July	32
4.1	Plenary Talk (09:00 – 10:00): Green's Function Solutions for Non-linear Single Phase Gas Flow in Porous Media: Petroleum Reservoir Engineering Applications	32
4.2	Seminars (10:30 – 18:00)	33
4.2.1	Session 20 (10:30 – 11:00): The Green Function Decomposition method (GFD_N) for anisotropic transport equation	33
4.2.2	Session 21 (11:00 – 11:30): The Adaptive Non-Extensive Particle Filter: The Q-Calculus Formalism	35
4.2.3	Session 22 (11:30 – 12:00): Multiphase Flow Splitting in Looped Pipelines	36
4.2.4	Session 23 (12:00 – 12:30): The Generalized Integral Laplace Transform Technique Applied In An Air Pollution Puff Model	37
4.2.5	Session 24 (12:30 – 13:00): An Analytical Solution For The Fractional Neutron Point Kinetics Equations	38
4.2.6	Session 25 (15:00 – 15:30): Analytical Study And Computational Radiative Fluxes In A Heterogeneous Medium	39
4.2.7	Session 26 (15:30 – 16:00): A Genuine Analytical Solution For The S_N Multigroup Neutron Equation In Planar Geometry	40
4.2.8	Session 27 (16:00 – 16:30): Tritium Dispersion After Emission From The Brazilian Angra Dos Reis Nuclear Power Plant: Validating A Closed Form Solution By Experiments	41

4.2.9	Session 28 (17:00 – 17:30): On The Fractal Pattern Phenomenology Of Geological Fracture Signatures From A Scaling Law	42
4.2.10	Session 29 (17:30 – 18:00): Solving Transport Problems With Wavelets Transforms	43
5	Sessions of the 27th of July	45
5.1	Plenary Talk (09:00 – 10:00): Fractional Calculus: Application in Modeling and Control	45
5.2	Seminars (10:30 – 16:30)	46
5.2.1	Session 30 (10:30 – 11:00): A Finite Element Method For Denoising Images	46
5.2.2	Session 31 (11:00 – 11:30): Methods For Image Restoration: Application To Medical And Astronomical Images .	47
5.2.3	Session 32 (11:30 – 12:00): Analysis Of A Non-Local Model For Spontaneous Cell Polarisation	48
5.2.4	Session 33 (12:00 – 12:30): Simple Eigenvalues For The Steklov Problem In A Domain With A Small Hole: A Functional Analytic Approach	49
5.2.5	Session 34 (12:30 – 13:00): Numerical Integration With The Singularity By Taylor Series	50
5.2.6	Session 35 (15:00 – 15:30): Homogenization of the Kelvin-Voigt model with degree of cure depending coefficients .	51
5.2.7	Session 36 (15:30 – 16:00): Single-Phase Flow Instabilities: Effect Of Pressure Waves In A Pump-Pipe-Plenum-Choke System	52
5.2.8	Session 37 (16:00 – 16:30): Two-Phase Flow Instabilities In Oil Wells: ESP Oscillatory Behavior And Casing-Heading	53

2.2 Seminars (10:30 – 12:30)

2.2.1 Session 04 (10:30 – 11:00): Operational Ionospheric Dynamics Prediction For South America

Adriano Petry, Jonas R. de Souza, Haroldo F. de Campos Velho
André G. Pereira, Graham J. Bailey
National Institute for Space Research (INPE)
São José dos Campos, SP, Brazil
adriano.petry@crs.inpe.br, jonas@dae.inpe.br
haroldo@lac.inpe.br

This work shows the development and preliminary results of operational ionosphere dynamics prediction system for South America region, based on an enhanced version of Sheffield University Plasmasphere-Ionosphere Model (SUPIM), a physics-based model computer code describing the distribution of ionization within the Earth mid to equatorial latitude ionosphere and plasmasphere. The model outputs are given in a 2-dimensional plane aligned with Earth magnetic field lines, with fixed magnetic longitude coordinate. The code was adapted to improve output stability, and to run in parallel using high performance computing (HPC) hardware. The outputs are geographical coordinates, using the Earth's magnetic field model as an eccentric dipole, based on the International Geomagnetic Reference Field (IGRF-11) approximation. During the system operation, several simulation runs are performed at different longitudes. A parallel version for the code was developed for enhancing the performance. After preliminary tests, it was frequently observed code instability, mainly for periods of low ionization, when negative ion temperatures or concentrations are found. After a detailed analysis, it was verified that most of these problems occurred due to concentration estimation of simulation points located at high altitudes, typically over 4000 Km of altitude. In order to force convergence, an artificial exponential decay for ion-neutral collisional frequency was used above mentioned altitudes. This approach shown no significant difference from original code output, but improved substantially the code stability. In order to make operational system even more stable, the initial altitude and initial ion concentration values used on exponential decay equation are automatically changed when convergence is not achieved, within pre-defined values. When all code runs end, an approximate neighbor searching technique was developed to obtain the ion concentration values in a regularly spaced grid, using inverse distance weighting (IDW) interpolation. A 3D grid containing ion and electron concentrations is generated for every hour of simulated day. Its spatial resolution is 1 degree of latitude per 1 degree of longitude per 10 Km of altitude. The vertical total electron content (VTEC) is calculated from the grid, and plotted in a geographic map. The whole process runs every day and predicts the VTEC values for South America region with up to 24 hours ahead. The maps are available at www.inpe.br/climaespacial/. Recently, data from ionosondes can be assimilated in the system to improve its accuracy.