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Organisations

PhD Student, Department of Informatics and Mathematical Modeling
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PhD Student, Department of Applied Mathematics and Computer Science
27/12/2012 → 31/10/2013 Former
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Image Analysis and Computer Graphics
25/02/2012 → 18/02/2013 Former
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Publications:

Multidimensional Big Spatial Data Modeling Through A Case Study: Lte Rf Subsystem Power Consumption Modeling
This paper presents a case study for comparing different multidimensional mathematical modeling methodologies used in multidimensional spatial big data modeling and proposing a new technique. An analysis of multidimensional modeling approaches (neural networks, polynomial interpolation and homotopy continuation) was conducted for finding an approach with the highest accuracy for obtaining reliable information about a cell phone consumed power and emitted radiation from streams of measurements of different physical quantities and the uncertainty ranges of these measurements. The homotopy continuation numerical approach proved to have the highest accuracy (97%). This approach was validated against another device with a different RF subsystem design. The approach modelled the power consumption of the validation device with an accuracy of 98%.

General information
State: Published
Organisations: National Space Institute, Geodesy, Micromove.com
Authors: Antón Castro, F. (Intern), Musiige, D. (Intern), Mioc, D. (Intern), Laulagnet, V. (Ekstern)
Pages: 208 - 219
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Volume: 11
Issue number: 3
ISSN (Print): 1755-7437
Ratings:
Scopus rating (2016): SJR 0.131 SNIP 0.365 CiteScore 0.24
Scopus rating (2015): SJR 0.115 SNIP 0.176 CiteScore 0.13
Scopus rating (2014): SJR 0.107 SNIP 0.084 CiteScore 0.19
Scopus rating (2013): SJR 0.219 SNIP 0.692 CiteScore 0.61
Scopus rating (2012): SJR 0.221 SNIP 0.421 CiteScore 0.46
Scopus rating (2011): SJR 0.207 SNIP 0.481 CiteScore 0.55
Scopus rating (2010): SJR 0.111 SNIP 0.62
Scopus rating (2009): SJR 0.157 SNIP 0.305
Original language: English
Big spatial data, Haskell, Homotopy continuation, Interval analysis, Mathematical modeling
Electronic versions:
Pages_from_eDNE_V11_N3.pdf
DOIs:
10.2495/DNE-V11-N3-208-219
Publication: Research - peer-review › Journal article – Annual report year: 2016
RF subsystem power consumption and induced radiation emulation
The thesis introduces a novel approach towards the emulation of the RF subsystem power consumption when transmitting a LTE signal. The RF subsystem which is made up of analog components has not been covered by the status quo emulation methodologies which are compatible with digital circuits. Though the study of the RF subsystem architectures revealed numerous architectures with different impacts on power consumption, we have decided to consider the RF subsystem as a black box.

The RF subsystem power emulation has been studied for the telecommunication technology Long Term Evolution (LTE). Given the fact that major power consumptions of wireless devices are largely functions of sequences of protocol/logical activities, it is this technology that provided the inputs to the RF subsystem as a black box which are Tx power, carrier frequency and signal bandwidth. The physical environmental variable temperature has also proven to be very influential on power consumption. These inputs also do constitute to the input parameters of the emulation methodology.

The emulation methodology has been proven to be a mathematical mapping between the input parameters and a predefined mathematical model. For the mathematical model, multivariate modeling approaches were analyzed for an approach with the least modeling error and complexity. Herein, the homotopy continuation numerical approach proved to have the least modeling error of 3%. The RF subsystem power consumption has been emulated with accuracies of 84% ±2.25% and 94.3% ±2.25% on different devices.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science , National Space Institute, Geodesy
Authors: Musiige, D. (Intern), Anton, F. (Intern), Mioc, D. (Intern)
Number of pages: 132
Publication date: 2013

LTE modem power consumption, SAR and RF signal strength emulation
This paper presents a new methodology for emulating the LTE modem power consumption, emitted SAR and RF signal strength when transmitting an LTE signal. The inputs of the methodology are: modem logical/protocol commands, time advance, near-field specifier, and antenna characteristics. The power emulation model(s) are computed by a two layer 451 neural network based on physical power measurements. SAR is emulated by polynomial interpolation models based on FDTD simulations. The accuracies of the mathematical function approximations for the emulation models of power and SAR are 5.19% and 3.6% respectively. The RF signal strength is emulated by an analytical model.

General information
State: Published
Organisations: National Space Institute, Geodesy, Renesas Mobile Europe
Authors: Musiige, D. (Intern), Vincent, L. (Ekstern), Anton, F. (Intern)
Number of pages: 6
Publication date: 2012

Host publication information
Title of host publication: IV International Congress on Ultra Modern Telecommunications and Control Systems 2012
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 4th International Congress on Ultra Modern Telecommunications and Control Systems (ICUMT 2012), St. Petersburg, Russian Federation, 03/10/2012 - 03/10/2012
DOIs: 10.1109/ICUMT.2012.6459664
Source: dtu
Source-ID: u::6030
LTE RF subsystem power consumption modeling
This paper presents a new power consumption emulation model, for all possible scenarios of the RF subsystem, when transmitting a LTE signal. The model takes the logical interface parameters, Tx power, carrier frequency and bandwidth between the baseband and RF subsystem as inputs to compute the power consumption. An analysis of modeling approaches was conducted and the modeling approach with the least sum of squared errors is used to compute the emulation model. The neural networks applying the Pseudo-Gauss Newton algorithm for optimization proved to have the least sum of squared errors. This approach was validated against a real life scenario with a relative error of 5.77%.

General information
State: Published
Organisations: National Space Institute, Geodesy, Renesas Mobile Europe
Authors: Musiige, D. (Intern), Vincent, L. (Ekstern), Anton, F. (Intern), Mioc, D. (Intern)
Pages: 645-649
Publication date: 2012

RF power consumption emulation optimized with interval valued homotopies
This paper presents a methodology towards the emulation of the electrical power consumption of the RF device during the cellular phone/handset transmission mode using the LTE technology. The emulation methodology takes the physical environmental variables and the logical interface between the baseband and the RF system as inputs to compute the emulated power dissipation of the RF device. The emulated power, in between the measured points corresponding to the discrete values of the logical interface parameters is computed as a polynomial interpolation using polynomial basis functions. The evaluation of polynomial and spline curve fitting models showed a respective divergence (test error) of 8% and 0.02% from the physically measured power consumption. The precisions of the instruments used for the physical measurements have been modeled as intervals. We have been able to model the power consumption of the RF device operating at 5MHz using homotopy between 2 continuous power consumptions of the RF device operating at the bandwidths 3MHz and 10MHz.

General information
State: Published
Organisations: Image Analysis and Computer Graphics, Department of Informatics and Mathematical Modeling, Geodesy, National Space Institute, Renesas Mobile Europe
Authors: Musiige, D. (Intern), Anton, F. (Intern), Yatskevich, V. (Ekstern), Vincent, L. (Ekstern), Mioc, D. (Intern), Pierre, N. (Ekstern)
Pages: 147-153
Publication date: 2011
Conference: International Conference on Computer, Electrical, and Systems Sciences, and Engineering, Singapore, Indonesia, 01/01/2011
Main Research Area: Technical/natural sciences

Publication information
Journal: World Academy of Science, Engineering and Technology. Proceedings
Volume: 81
ISSN (Print): 2070-3740
Ratings:
Scopus rating (2014): SJR 0.132 SNIP 0.323
Scopus rating (2013): SJR 0.125 SNIP 0.276
Scopus rating (2012): SJR 0.122 SNIP 0.234
BFI (2011): BFI-level 1
Projects:

Emulated power and radiance minimization for safer cellular phones with longer lasting batteries

Department of Informatics and Mathematical Modeling
Period: 01/01/2010 → 25/10/2013
Number of participants: 6
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Examiner:
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De La Cruz Blas, Carlos A. (Ekstern)
Prasad, Ramjee (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD