Hisham bin Zubair

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75400 Karachi, Pakistan
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Education:

Standards and dates

(1) Post-doctoral research. March 2009 – March 2010 ***(Postdoc)***
Department of Mathematics and Computer Sciences. (Wiskunde-Informatica)
Campus Middelheim, University of Antwerp, Belgium.
Main research description: Development of fast iterative solvers for the indefinite Helmholtz equations arising in Quantum Mechanical studies.
In collaboration with: Prof. Dr. Wim Vanroose.
Research theme(s): Computational Physics.
{Embarked soon after primary approval of the PhD dissertation, March 2009}.

(2) Defense of the Ph.D. dissertation. September 1, 2009, ***(PhD Appl. Math.).***
Delft Institute of Applied Mathematics. Numerical Analysis Group.
Delft University of Technology. Delft, The Netherlands.
Dissertation title: Efficient Multigrid Methods based on Improved Coarse Grid Correction Techniques.
PhD Advisor: Prof.dr.ir. Cornelis W. Oosterlee.
Research themes(s): Financial Mathematics, Geophysics, Quantum Physics.
{PhD thesis formally published. ISBN # 978-90-9024398-6}

*(3) Masters. (Computer Science) 2003, (****MCS****)*
University of Karachi, Pakistan.
Developed a multivariate mathematical function interpreter based on Context-Free Grammar for the core named "Automata and the Theory of Formal Languages. The project was built in Java under JDK1.3.

(4) Masters. (Applied Mathematics) 1997, ***(MSc)***
University of Karachi, Pakistan.
{Exam based standard. Some interesting cores and electives included the theoretical study of Fluid Mechanics, Electromagnetism and Quantum Mechanics.}

*(5) Bachelors. (Applied Mathematics), 1996, (****BSc Hons.****)*
University of Karachi, Pakistan.
{Exam based standard. Some interesting cores and electives included Mathematical Physics, Classical Mechanics and Programming Languages.}

General Research interests:

Scientific computing in general; particularly, the development and implementation of iterative numerical techniques for efficient solution of partial differential equations that arise in various real-life applications.

- *Multigrid solution of anisotropic sub-problems occurring in the sparse-grid treatment of high-dimensional partial differential equations.*
- *Development of multilevel preconditioners for Krylov-subspace methods, such as Bi-CGSTAB and IDR(s).*
- *Implementation of numerical routines for sparse linear algebra.*
- *Development of geometric -and hybrid strategies for coarsening the discretization grid for various regular grid problems.*
- *Indefinite Helmholtz problems on equidistant and stretched grids.*

Journal Papers / preprints:

(1) ***Multigrid for High-dimensional Elliptic Partial Differential Equations on Non-Equidistant Grids,*** *H. bin Zubair, C.W. Oosterlee, and R. Wienands,*
SIAM Journal on Scientific Computing. *(2007),*
SISC Vol. 29, No. 4, pp 1613-1636.

(2) ***Efficient d-Multigrid Preconditioners for Sparse-Grid Solution of High-Dimensional Partial Differential Equations,*** *H. bin Zubair, C.C.W. Leentvaar, and C.W. Oosterlee.*
International Journal of Computer Mathematics. *(2007)*
IJCM. Vol. 84, No. 8, pp 1129-1147.

(3) ***A Geometric Multigrid Method Based on L-shaped Coarsening for PDEs on Stretched Grids,*** *H. bin Zubair, S. P. MacLachlan, and C. W. Oosterlee,*
Numerical Linear Algebra with Application *(2010)*
Numer. Linear Algebra Appl. 2010; 17:871–894
{Published online (August 17, 2009) in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/nla.665 }

(4) ***On the Indefinite Helmholtz Equation: Exterior Complex Scaled Absorbing Boundary Layers, Iterative Analysis, and Preconditioning.*** *B. Reps, W. Vanroose, and H. bin Zubair.*
Journal of Computational Physics *(2010),*
JCP, Volume 229, Issue 22, Pages 8384-8405

(5) ***A Preconditioned Iterative Solver for the Scattering Solutions of the Schrödinger Equation.*** *H. bin Zubair, B. Reps, W. Vanroose.*
Accepted for publication (10.08.10) in the following journal:
Communications in Computational Physics.
Preprint hosted on: http://arxiv.org/abs/1012.4307

(6) ***A Polynomial Multigrid Smoother for the Iterative Solution of the Heterogeneous Helmholtz Problem.*** *Wim Vanroose, Bram Reps, Hisham bin Zubair.*
Submitted: In Review.
Preprint hosted on: http://arxiv.org/abs/1012.5379

Fellowship and Awards:

(1) ***One of the top three winners of the Student Paper Competition held at the 13th Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado, USA (2007).***

On Multigrid for High-Dimensional Anisotropic Partial Differential Equations,
H. bin Zubair;
http://amath.colorado.edu/faculty/copper/2007/program.html

(2) Competitive selection and subsequent award of state-sponsored HEC Pakistan fellowship for PhD research in The Netherlands. (March 2004).

Presentations and Conference Talks:

(1) ***Multigrid preconditioning for the Indefinite Helmholtz equation on locally refined grids.***
H. bin Zubair.
14th Copper Mountain Conference on Multigrid Methods, (2009).
Copper Mountain, Colorado, USA.
http://grandmaster.colorado.edu/~copper/2009/program.html

(2) ***Multigrid for partial differential equations on stretched grids,***
H. bin Zubair, S.P. MacLachlan and C.W. Oosterlee.
Ninth European Multigrid Conference, ***EMG*** *(2008)*
Bad Herrenalb, Germany.

(3) ***Multigrid Preconditioners for Bi-CGSTAB for the Sparse-Grid Solution of High-Dimensional Anisotropic Diffusion Equation,***
H. bin Zubair and C.W. Oosterlee.
3rd International Conference on 21st Century Mathematics, (2007)
Abdus Salam School of Mathematical Sciences, GC University, Lahore, Pakistan.
Full paper appeared in ***The Journal of Prime Research in Mathematics****, Vol. 3, November, 2007, ISSN 1817-2725, Abdus Salam School of Mathematical Sciences, GCU, Lahore.*

(4) ***Multigrid Methods for High-dimensional Elliptic Equations,***
H. bin Zubair and C.W. Oosterlee;
Proceedings ***ECCOMAS*** *(2006)*
(European Conference on Computational Methods in Applied Sciences).
Egmond Aan Zee, The Netherlands.

Teaching experience:

- *Coordinated an MSc course "Multigrid and multilevel solution methods" with Prof. Dr. Wim Vanroose, at the University of Antwerp, Belgium. 2010.*
- *Lecturer, Mathematics, 2/1999 - 1/2005,*
  Department of Sciences,
  Textile Institute of Pakistan,
  EZ/1/P-8, Eastern Zone, Port Qasim Authority, Karachi, Pakistan.
  http://www.tip.edu.pk, Tel: +92 302 8285456-7, +92 301 8285456-7

Computer experience:

- *Scientific-Computing projects:*
  (1) Multigrid solver for anisotropic d-dimensional diffusion equation on non-equidistant grids over a d-dimensional hypercube domain.
  (Matlab® with Mex-C++ interface).
  (2) d-Multigrid preconditioner for Bi-CGSTAB. Preconditioner used for solving option pricing problems. (Matlab® with Mex-C++ interface).
  (3) Multigrid preconditioner for the 2-dimensional indefinite Helmholtz on locally refined and stretched grids, based on the conservative finite-volume scheme. (C++)

(4) Multigrid preconditioner for Exterior Complex Scaled Absorbing Boundary Layers, for the indefinite Helmholtz equation, based on the cell-centered Shortley-Weller discretization scheme. (Matlab® with Mex-C++ interface).

- *Coding languages:*
  FORTRAN77, C, Java, Matlab® C interface (mex).
- *Hands-on experience with Math packages:*
  Matlab®, Maple®, Minitab®.
- *Have worked under operating systems:*
  MS Windows®, Different Linux distributions and flavours.

Language proficiency:

- *Fluent in English, good speaking and writing skills.*
- *Native Urdu.*

References:

- *Prof. Dr. Wim Vanroose.(assoc. for Postdoc)*
  Wiskunde-Informatica,
  University of Antwerp,
  Middelheim Campus,
  Middelheimlaan 1,
  2020 Antwerpen, Belgium.
  Email: wim.vanroose@ua.ac.be
- *Prof.dr.ir. Cornelis W. Oosterlee, (PhD Advisor)*
  Centrum voor Wiskunde en Informatica (CWI),
  Dutch national research centre for mathematics and computerscience' Modelling, Analysis and Simulation (MAS2)
  Kruislaan 413, Amsterdam, The Netherlands
  Email: c.w.oosterlee@cwi.nl
- *Prof. Dr. Scott P. MacLachlan,*
  Department of Mathematics,
  Tufts University,
  Bromfield-Pearson Building,
  503 Boston Avenue, Medford,
  MA 02155, USA.
  Email: scott.maclachlan@tufts.edu
- *Prof.dr.ir. Kees Vuik, (Chairman, NW, Delft)*
  Numerieke Wiskunde,
  Delft Institute of Applied Mathematics
  Faculty of Electrical Engineering, Mathematics and Computer science, Delft University of Technology.
  Mekelweg 4, 2628 CD, Delft, The Netherlands
  Email: c.vuik@tudelft.nl

(Referral letters may be requested directly or through H. bin Zubair)