

*Summary of Activities*

**IFIP Working Group 2.5 (Numerical Software)**

This is the yearly summary of activities for IFIP Working Group 2.5. It covers the period of May 2006 through May 2007.

**Leadership**

Chair	Dr. Ronald F. Boisvert, National Institute of Standards and Technology, Gaithersburg, MD, USA
Vice-Chair	Professor Michael Thuné, University of Uppsala, Sweden
Secretary	Professor Wayne Enright, University of Toronto, Canada

**Membership**

The Working Group currently has 34 full members representing 13 countries. The Working Group has an additional 12 affiliate members. (Affiliates are former WG 2.5 full members who are interested in working group activities, but are unable to regularly attend meetings or commit large amount of time to working group projects. They maintain email contact, and attend Working Group meetings when possible. They are considered members of the Working Group by IFIP.)

The newest member of WG 2.5 is

Professor Shigeo Kawata  
Utsunomiya University  
Japan

He was approved by vote of the working group in July 2006.

**Aims and Scope**

WG 2.5 recently re-evaluated its statement of aims and scope with an eye to updating its viewpoint in light of current trends in the field. The result of this process was a re-affirmation of the basic aim of the group, i.e., *to improve the quality of scientific computation by promoting the development and availability of sound numerical software*. However, it was felt that a re-statement and clarification of the objectives that lie within its scope was needed. In July 2006, the group approved a modified scope statement, which is included in Appendix 1 of this report. An important feature of this new statement is an expanded (one-page) rationale for each of the topic areas identified in the scope statement. This rationale is also attached to this report (Appendix 1).

## **Business Meetings**

The working group holds yearly meetings. These are typically comprised of a two-day business meeting and an associated two-day workshop. The workshop provides an opportunity for the working group to interact with researchers in the local region on issues of mutual interest. The workshops are usually informal. The Working Group holds Working Conferences in association with some of its meetings. The most recent WG 2.5 meeting was held in conjunction with a Working Conference. The most recent and planned meetings are given in the table below.

<b>Year</b>	<b>Dates</b>	<b>Location</b>	<b>Host</b>	<b>Meeting Theme</b>
2006	July 15-21	Prescott, Arizona, USA	California Institute of Technology (Dr. James C. T. Pool)	Working Conference 9: Grid-based Problem-Solving Environments
2007	August 13-14	Uppsala, Sweden	University of Uppsala (Prof. Michael Thuné)	Software Issues in Computational Science and Engineering
2008		Toronto, Canada	University of Toronto (Prof. Wayne Enright)	

The agenda of the July 2006 WG 2.5 business meeting can be found in Appendix 2 of this report.

## **Status of Major WG 2.5 Activities**

### **1. WG 2.5 Working Conference 9**

Working Group 2.5 organized an IFIP Working Conference on *Grid-Based Problem Solving Environments: Implications for Development and Deployment of Numerical Software* which was held July 17-21, 2006 in Prescott, Arizona, USA. The web site for the conference is <http://www.woco9.org/>.

In this context, the phrase “Grid-Based Problem Solving Environments” is synonymous with “science gateways” or “science portals”, nomenclature introduced recently by the grid community. The conference was designed to bring together members of four communities:

- users of both grid-based and traditional problem solving environments;
- developers of both grid-based and traditional problem solving environments;
- developers of grid infrastructure; and
- developers of numerical software.

The use of the Internet to bring together providers and users of computational resources has become commonplace. Web-based services such as NetSolve (for linear algebra) and NEOS (for nonlinear and optimization problems) have demonstrated the potential of grid-based problem solving environments (PSEs) from the numerical software perspective. Domain specific PSEs, such as Cactus (developed for numerical relativity) and PYRE (developed for shock physics), have been applied outside their original discipline to

generate new PSEs and are being extended to exploit grid technology. Likewise, many tools exist for making a service available. However, there is more to making use of a grid-based service than simply knowing its web address. Does the service work reliably? What are its limitations? Can it be combined with other services? There are also opportunities for improving the ability of applications to use the best numerical software, for example, by simplifying the acquisition and use of high-quality numerical software. The development of numerical software can benefit from the experience of the scientific and engineering communities using and developing new grid-based PSEs, for example, defining interfaces more appropriate for integrating numerical software into grid-oriented applications and exploiting test sets and tools for comparing different methods.

Issues considered by this working conference included:

- accuracy contracts and software services;
- standards for problem specification;
- service models for the use of numerical software;
- using the grid to link numerical and other services together;
- experiences with web-based numerical services;
- application-oriented numerical interfaces such as web portals;
- software deployment issues including updates and bug fixes;
- large data (including data security) and grid-based numerical software;
- grid-based services as an alternative to deployment; and
- evaluation and comparison of both production and research software.

This conference was built upon the experience and insights gained during past working conferences organized by WG2.5, in particular, [WoCo4: Problem Solving Environments for Scientific Computing](#), [WoCo6: Programming Environments for High-Level Scientific Problem Solving](#), and [WoCo8: Software Architectures for Scientific Computing Applications](#).

The Working Conference was sponsored by IFIP and the Center for Advanced Computing Research at the California Institute of Technology in cooperation with the Society for Industrial and Applied Mathematics (SIAM). Additional financial support was obtained from Hewlett-Packard, Intel and NAG.

The organizational structure for the working conference was as follows.

**Chair**

James C. T. Pool, Retired, formerly Executive Director, Center for Advanced Computing Research, California Institute of Technology

**Deputy Chair**

Brian Ford, Mathematics Faculty, Oxford University and Founding Director, Numerical Algorithms Group

**Executive Committee**

Conference Chair

Deputy Conference Chair

Program Committee Chair

WG2.5 Chair: Ronald F. Boisvert, Mathematical and Computational Sciences Division, National Institute of Standards and Technology

### **Program Committee**

Chair: William D. Gropp, Mathematics and Computer Science Division, Argonne National Laboratory

Dennis Gannon, Department of Computer Science, Indiana University

Jennifer Schopf, Mathematics and Computer Science Division, Argonne National Laboratory and UK National e-Science Centre, University of Edinburgh

Masaaki Shimasaki, Department of Electrical Engineering, Kyoto University

Michael Thuné, Department of Information Technology, Uppsala University

Anne Trefethen; Interdisciplinary e-Research Centre; Oxford University

Conference Chair

Conference Deputy Chair

Proceedings Co-Editors

### **Proceedings Co-Editors**

Conference Chair

Patrick W Gaffney, Bergen Software Services International A/S, Bergen, Norway

Note that all Conference organizers except Gannon, Schopf, and Trefethen are members of WG 2.5.

The following 28 persons spoke at the conference.

Jay	Alameda	National Center for Supercomputing Applications
Gabrielle	Allen	Louisiana State University
Mutsumi	Aoyagi	Kyushu University
Bill	Appelbe	Victorian Partnership for Advanced Computing (VPAC)
Vania	Boccia	University of Naples
Justin	Burruss	General Atomics
Craig	Douglas*	University of Kentucky
Pat	Gaffney*	Bergen Software Services International
Dennis	Gannon	Indiana University
Marc	Garbey	University of Houston
Sebastien	Goasguen	Purdue University
Kieth	Jackson	Lawrence Berkeley National Laboratory
Tom	Jackson	University of York
Ken	Kennedy	Rice University
David	Keyes	Columbia University
Suman	Nadella	Argonne National Laboratory
Boyana	Norris	Argonne National Laboratory
Julian	Padget	University of Bath
Beth	Plale	Indiana University
Brian	Smith*	Numerica21 & University of New Mexico
Vaidy	Sunderam	Emory University
Jem	Treadwell	Hewlett-Packard
Anne	Trefethen	Oxford University
Hitohide	Usami	National Institute of Informatics
Mladen	Vouk*	North Carolina State University

David	Walker	University of Cardiff
Xiaoge	Wang	Tsinghua University
Asim	Yarkhan	University of Tennessee at Knoxville

\* Member of Working Group 2.5

Seventeen members of WG 2.5 participated in the working conference. In total, more than 50 persons attended.

The complete program for the conference is provided in Appendix 3 of this report. The conference proceedings are currently being compiled and will be published in book form by the IFIP Publisher. The final manuscript will be delivered to the IFIP publisher in the next few weeks.

## 2. Minisymposium at the International Congress on Industrial and Applied Mathematics

WG 2.5 members Ronald Boisvert and Brian Ford have organized a minisymposium for the International Congress on Industrial and Applied Mathematics (ICIAM) to be held in Zurich, July 16-20, 2007. Entitled “Recent Advances in Software Tools for Scientific Computing,” the minisymposium will feature eight technical talks on subjects of interest to WG 2.5, four of which will be presented by active WG 2.5 members. The event will be dedicated to James C. T. Pool, a long-time member of WG 2.5 who retired from the California Institute of Technology last year. An abstract of this Minisymposium is included as Appendix 4 of this report.

## 3. WG 2.5 Workshop on Software Issues in Computational Science and Engineering

The next WG 2.5 business meeting will be held at the University of Uppsala, Sweden, on August 13-14, 2007. In association with this meeting, WG 2.5 will co-host a workshop entitled “Software Issues in Computational Science and Engineering”. This is one of a series of informal local workshops held in conjunction with the yearly WG 2.5 business meetings. These workshops provide a venue for WG 2.5 members to interact with researchers and practitioners in the local region who are interested in numerical software. The workshop is being organized by WG 2.5 Vice-Chair Professor Michael Thuné (University of Uppsala), Professor Sverker Holmgren (Uppsala University), and Dr. Hans Petter Langtangen (Simula Research Laboratory and Oslo University). The web site for the meeting is <http://www.it.uu.se/research/conf/SCSE07>. The preliminary program for the workshop is included as Appendix 5 of this report.) Speakers for the workshop represent the following institutions: Friedrich-Schiller-Universität Jena, Universität Dortmund, Universität Erlangen, Uppsala University, von Karman Institute for Fluid Dynamics, Simula Research Laboratory, TU München, Argonne National Laboratory, Visual Numerics Inc., Umeå University, and the University of Bergen.

# Appendix 1

## Aim and Scope of IFIP Working Group 2.5

The aim of Working Group 2.5 (WG 2.5) is to improve the quality of scientific computation by promoting the development and availability of sound numerical software.

Objectives within the scope of the WG 2.5 are:

1. **Environment.** The definition from a numerical standpoint of a set of hardware and software features for a computing system.
2. **Tools.** The development and improvement of programming languages and other tools for numerical computation.
3. **Algorithms.** The establishment of guidelines for the assessment of numerical algorithms and their implementations.
4. **Software.** The establishment of guidelines for the preparation, interoperability, verification, validation, documentation, distribution and maintenance of numerical software.
5. **Data.** The establishment of guidelines for the validation, documentation, preservation, and distribution of numerical data.
6. **Communication.** The exchange of information concerning numerical software and the determination of the needs of computer users.

### Rationale

As an arm of IFIP Technical Committee 2, *Software: Theory and Practice*, WG 2.5 is concerned with those aspects of software development, dissemination, and use that stem from the unique nature of numerical computation. Such concerns arise primarily in computing applications, where the solution of problems that rely on applied mathematics and numerical computation provide a foundation. Developers of numerical software share many goals with software developers in other domains, such as correctness, reliability, efficiency, usability, and maintainability. However, the nature of mathematical algorithms and the details of their implementation on finite precision computational devices pose additional challenges in areas of accuracy, numerical error control, robustness, portability, and testing. The goal of WG 2.5 is to focus attention on the unique challenges posed by the development of numerical software in order to yield continuing improvements in the quality of scientific computation.

Objectives in a variety of areas stem from this overall goal.

**Environment.** The difficulty of producing efficient, stable, robust and portable numerical software is greatly influenced by the numerical properties of the underlying computer hardware, as well as the access to its facilities provided by low level system functions. Thus, WG 2.5 seeks to influence the design of such hardware and software

features with the aim of improving the environment for the production of high quality numerical software.

**Tools.** The ease with which high quality numerical software can be produced is strongly influenced by the availability of software tools, such as language processors, code transformers, debuggers, source code control systems, error trackers, documentation systems, etc. These tools should have capabilities that support the unique needs of numerical software developers. For example, developing programming language features that support capabilities such as fine control of floating-point operations, complex arithmetic, array operations, and parallel computing is of particular concern to WG 2.5.

**Algorithms.** Numerical algorithms are the foundation of numerical software. WG 2.5 seeks to characterize those properties of numerical algorithms that lead to implementations of highest quality, and to develop metrics, protocols and tools, for the comparison of implementations of numerical algorithms.

**Software.** Numerical software itself is the primary topic for WG 2.5. Of particular concern are issues such as verification, reusability, interoperability, documentation, distribution and maintenance in the context of mathematical algorithms and floating-point arithmetic. The establishment of guidelines, standards, and tools are primary means for improving the state-of-the-art in this area.

**Data.** Numerical data is a critical concern for producers and users of numerical software. Dealing with large volumes of such data, both as input and as output of software is becoming a difficult challenge. As a result, application communities are establishing guidelines and standards for the validation, documentation, preservation, and exchange of mathematical data, both numeric and symbolic. WG 2.5 has a natural interest in establishing and promulgating the best practices for the management of fundamental mathematical data.

**Communication.** WG 2.5 seeks to communicate issues, best practices, guidelines, and other information to developers and users of numerical software. It also works to represent the interests of the numerical software community in standards development for hardware, languages, software, and related information exchange. This is achieved through a combination of meetings, workshops, conferences, technical documents, books, and web sites. Of particular emphasis is the widespread promulgation of high quality numerical computation through international cooperation.

*Approved by IFIP WG 2.5  
16 July 2006*

# Appendix 2

## IFIP WG 2.5 Business meeting

July 15-16, 2006

Prescott, Arizona, USA

**Location** Arizona Room, Hassayampa Inn (<http://www.hassayampainn.com/>)

**Host** Dr. James C. T. Pool

### Saturday July 15

08:00 Registration, Breakfast

*WG Business ...*

09:00 Opening and welcome  
Review of the agenda  
Minutes of last meeting

09:15 Report from Annual TC2 Meeting (Einarsson)

*Technical Presentations ...*

09:30 An Investigation of the Reliability/Efficiency Trade-off in ODE Solvers (Enright)

10:15 **Break**

10:45 Numerical Methods and Software for Multi-modeling Applications (Mu)

11:30 Benchmarking HPC Systems (Reid)

12:00 **Lunch**

*WG Business ...*

13:00 Nominations of new members

13:15 Review of WG 2.5 Aims and Scope statement

13:45 Review of WG 2.5 Projects

14:30 **Break**

15:00 Continue Review of WG 2.5 Projects

15:30 Discussion: Revised IEEE 754 (new deadline Dec 2006), see [http://en.wikipedia.org/wiki/IEEE\\_754r](http://en.wikipedia.org/wiki/IEEE_754r)

*Technical Presentation ...*

15:45 Digital Library of Mathematical Functions (Boisvert)

16:30 **Adjourn**

17:45 Travel to Pool residence

## **Sunday July 16**

08:00 Registration, Breakfast

08:45 Opening Remarks

*Technical Presentation ...*

09:25 UK e-Science Programme (Anne Trefethen)

10:15 **Break**

*WG Business ...*

10:30 Review of TC2 (Meersman)

11:00 Discussion: Follow-on Activities to WoCo9 (Pool)

11:15 Plans for WG 2.5 2007 meeting (Thuné)

11:45 Discussion of Future Meetings

- Preliminary plans for WG meeting in Canada, 2008 (Enright)
- Future meetings of WG 2.5: 2009 and beyond
- Other future meetings of interest

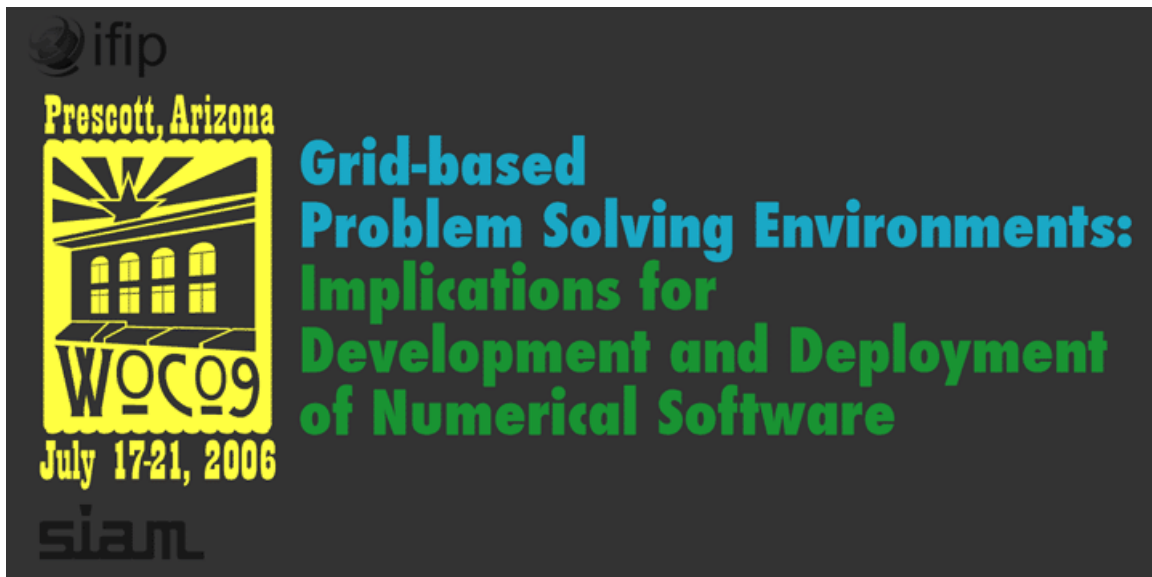
12:00 Vote on Revised Aims & Scope Statement

12:15 Membership

- Vote on new members
- Discussion of future nominees for membership

12:30 **Adjourn**

## Appendix 3



### Schedule of Events

#### Sunday, July 16

- 16:00 Registration; Marina Room (Conference Center)
- 18:00 Reception & Registration; Marina Room (Conference Center)

#### Monday, July 17

- 8:00 Breakfast & Registration; Arizona Room (Hotel)  
NOTE: Registration will continue during the morning break in the Marina Room (Conference Center)
- 8:45 Opening Session: J. Pool, Chair; Marina Room (Conference Center)
- 9:00 **Workflow Tools**  
W. Gropp, Session Chair  
D. Gannon: [Scientific Gateways and Workflow Tools](#)
- 9:45 K. Kennedy: [Why Performance Models Matter for Grid Computing](#)
- 10:30 Break
- 11:00 M. Vouk: [Automation of Large-scale Network-Based Scientific Workflows using Kepler: Tools and Case Studies](#)
- 11:45 Discussion
- 12:15 Conference Lunch; Arizona Room

- 13:30 **Application Experience**  
R. Boisvert, Session Chair  
P. Gaffney & T. Hopkins: [Virtual Manufacturing - The Vision for Virtual Paint Operations](#)
- 14:15 J. Burruss: [Service-oriented Computation in Magnetic Fusion Research](#)
- 15:00 Break
- 15:30 D. Walker: [Lessons Learned from the GECEM Portal](#)
- 16:15 A. Trefethen: The UK e-Science Programme
- 17:00 Discussion
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- 18:30 Reception
- 19:30 Conference Dinner

## Tuesday, July 18

- 8:00 Breakfast; Arizona Room
- 8:45 Opening Session: J. Pool, Chair; Marina Room (Conference Center)
- 9:00 **Infrastructure: Services**  
A. Trefethen, Session Chair  
J. Treadwell: [Open Grid Services Architecture](#)
- 9:45 B. Norris: [Computational Quality of Service for Scientific Component Applications](#)
- 10:30 Break
- 11:00 T. Jackson: [A Middleware Webservice Architecture for Distributed Search Applications](#)
- 11:45 Discussion
- 12:15 Conference Lunch; Arizona Room
- 13:30 **Infrastructure: Numerical Software**  
W. Enright, Session Chair  
X. Wang: [THCORE: A Component Runtime for Service Oriented Numerical Software](#)
- 14:15 K. Jackson: [Python Tooling for Wrapping Numerical Codes as Grid Services](#)
- 15:00 Break
- 15:30 A. YarKhan: [NetSolve to GridSolve: The Evolution of a Network Enabled Server](#)
- 16:15 B. Smith: [A Test Harness TH For Numerical Applications and Libraries](#)
- 17:00 Discussion
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- 20:00 Hot Topics: P. Gaffney, Session Chair; 10 minute talks with 5 minute Q&A

## Wednesday, July 19

- 8:00 Breakfast; Arizona Room

- 8:45 Opening Session: J. Pool, Chair; Marina Room (Conference Center)
- 9:00 **Event Driven Applications**  
 D. Gannon, Session Chair  
 C. Douglas: [Dynamic Data-Driven Wildfire Tracking](#)
- 9:45 G. Allen: [Designing a Dynamic Data Driven Application System for Coastal and Environmental Modeling](#)
- 10:30 Break
- 11:00 S. Nadella: [SPRUCE: A System for Supporting Event-Driven and Urgent High-Performance Computing](#)
- 11:45 B. Plale: [Dynamic Environment Driven Computational Science and its Terascale Data: Keeping the Human in the Loop](#)  
 Discussion (See Thursday evening)
- 14:15 Guided Tour of Sharlot Hall Museum
- 15:30 Visit Sharlot Hall Museum, The Palace on Whisky Row, and/or downtown shops and galleries
- 18:00 Buffet Dinner; Arizona Room
- 19:00 Mr. and Mrs. Wyatt Earp; Arizona Room

### **Thursday, July 20**

- 8:00 Breakfast; Arizona Room
- 8:45 Opening Session: J. Pool, Chair; Marina Room (Conference Center)
- 9:00 **Applications**  
 M. Thuné, Session Chair  
 M. Garbey: [Efficient Algorithm to Compute PDEs on the Grid](#)
- 9:45 J. Alameda: [On the Use of Services to Support Numerical Weather Prediction](#)
- 10:30 Break
- 11:00 J. Padget: [Mathematical Service Discovery](#)
- 11:45 Discussion
- 12:15 Conference Lunch; Arizona Room
- 13:30 **Applications; Continued**  
 M. Thuné, Session Chair  
 H. Usami: [A Problem Solving Environment based on Grid Services: NAREGI-PSE](#)
- 14:15 M. Aoyagi: [Grid Enabling of Nano-Science Applications in NAREGI](#)
- 15:00 Break
- 15:45 S. Goasguen: [Grid Architecture for Scientific Communities](#)
- 16:15 B. Applebe: [Scientific Software Frameworks and Grid-enabled Applications - StGermain Deployment and Applications Experiences](#)

17:00 Discussion

20:00 Discussion: J. Pool, Session Chair; Event Driven Applications

### **Friday, July 21**

8:00 Breakfast; Arizona Room

8:45 Opening Session: J. Pool, Chair; Marina Room (Conference Center)

9:00 **Grid-based Imaging**

B. Ford, Session Chair

V. Boccia: [MedIGrid: A Medical Imaging PSE for Computational Grids](#)

9:45 D. Keyes: [Grid-based Image Registration](#)

10:30 Break

11:00 Discussion

11:30 Conference Summary; Strategy for Future Activities

12:15 Conference Lunch; Arizona Room

# Appendix 4

## Recent Advances in Software Tools for Scientific Computing

### *Minisymposium*

International Congress on Industrial and Applied Mathematics

Zurich, 16-20 July 2007

<http://www.iciam07.ch/>

Computation has become an indispensable tool for progress in science and engineering. For applied mathematicians and computer scientists who develop mathematical software tools, the central question remains the same as it was in the early days of computing: how should mathematical software be designed to get the highest performance possible, while remaining cost-effective to develop and maintain, as well as easy for users to deploy? The computing landscape today, however, is far different than it was when general purpose electronic computers emerged some 50 years ago. While processors have become cheap and ubiquitous, their underlying computer architectures have actually become more complex. Today such systems have multi-level hierarchical memory systems, multiple processors per chip, special-purpose co-processors, etc. On the Web, emerging service-oriented architectures (computational grids) envision the ad-hoc marshaling of disparate and widely distributed resources to attack computational problems and to share results. At the high end, hundreds to thousands of processors and memory systems are linked together into complex interconnection networks to address society's most challenging problems. Designers of mathematical software libraries, problem-solving environments, and related tools, which provide users with the capabilities needed to efficiently exploit such systems for practical use, are being challenged anew to develop scientific computing tools for this increasingly complex computing landscape. In this minisymposium, we will review how researchers and developers of scientific computing tools are addressing these issues. Speakers will review the state-of-the-art in mathematical software design, including emerging numerical algorithms, software architectures, user interfaces, testing methodologies, as well as some selected applications. (This minisymposium is dedicated to Dr. James C.T. Pool on the occasion of his recent retirement.)

*Organizers:* Ronald F Boisvert and Brian Ford

### **Session 1**

1. *Reflections on Progress in Software Tools for Numerical Software*  
Brian Ford, NAG, Ltd.
2. *Mathematical Software and MATLAB*  
Cleve Moler, The MathWorks, Inc.

3. *Recent Progress in LAPACK and ScaLAPACK Libraries for Numerical Linear Algebra*  
Sven Hammarling, NAG, Ltd.
4. *The Challenges of Multicore and Specialized Accelerators for Mathematical Software*  
Jack Dongarra, University of Tennessee at Knoxville

## **Session 2**

5. *The Evolution of Software for Computational Optimization*  
Jorge J More, Argonne National Laboratory
6. *A Test Harness TH For High Performance Numerical Software*  
Brian T Smith, University of New Mexico
7. *Special Functions, Reference Data and Mathematical Software*  
Ronald F Boisvert, NIST
8. *Evolution of Mathematical Software*  
James C.T. Pool, California Institute of technology (retired)

# **Appendix 5**

## **Preliminary Workshop Program Software Issues in Computational Science and Engineering**



UPPSALA  
UNIVERSITET

2007-05-16

Workshop

## **Software Issues in Computational Science and Engineering**

Uppsala University, Sweden  
August 15–16, 2007

### *Preliminary Program*

Wednesday, August 15, 2007

09:00            Opening Remarks

#### *Session 1*

*Chair:* Sverker Holmgren

09:15            Keynote 1: Bill Gropp, Argonne National Laboratory  
                  Title to be announced

10:15 Break

10:45            Gerhard Zumbusch, Friedrich-Schiller-Universität Jena  
                  *Domain-Specific Parallel Programming Models  
                  for Numerical Computation*

11:15            Dominik Goeddeke, Universität Dortmund  
                  *Minimally Invasive Integration of GPUs to Improve Multigrid  
                  Solver Performance on a Cluster*

11:45 Lunch

#### *Session 2*

*Chair:* Hans Petter Langtangen

13:00            Christoph Pflaum, Universität Erlangen  
                  *Expression Templates and Applications*

13:30            Malin Ljungberg, Uppsala University  
                  *Composable Difference Operators for Coordinate Invariant  
                  Partial Differential Equations*

14:00            Tiago Quintino, von Karman Institute for Fluid Dynamics  
                  *Runtime Automatic Generation of Template Static Binded Code*

14:30 Break



- 15:00 Anders Logg, Simula Research Laboratory  
*Finite Element Code Generation: Simplicity, Generality, Efficiency*
- 15:30 Ioan Muntean, TU München  
*Software Engineering meets Scientific Computing—Group Projects in CSE Education*
- 16:00 Kent-André Mardal, Simula Research Laboratory  
*Finite Elements with Symbolic Computations and Code Generation*

16:30 Adjourn for day

xx:xx Workshop dinner at Restaurant Eklundshof

Thursday, August 16, 2007

**Session 3**

**Chair:** Michael Thuné

- 09:00 Richard Hanson, Visual Numerics, Inc.  
*Solving Constrained Differential-Algebraic Systems Using Projections*
- 09:30 Pearu Peterson, Simula Research Laboratory  
*The G3 F2PY for connecting Python and Fortran 90 programs*
- 10:00 Break
- 10:30 Bo Kågström, Umeå University  
Title to be announced
- 11:00 Magne Haveraaen, University of Bergen  
*Coordinate-Free Numerics: All Your Variation Points for Free?*
- 11:30 Break
- 11:45 Keynote 2: Sverker Holmgren, Uppsala University and Swedish National Infrastructure for Computing  
Title to be announced
- 12:45 Closing Remarks
- 13:00 Workshop closes