Get Ready for PhD Dissertation

Technical Preparations

Chensong Zhang
LSEC & NCMIS
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The Origin ...

HOW PROFESSORS SPEND THEIR TIME

- How they actually spend their time:
  - Teaching: 59%
  - Research: 18%
  - Service: 23%

- How departments expect them to spend their time:
  - Teaching: 20%
  - Research: 175%
  - Service: 20%

- How Professors would like to spend their time:
  - Don’t tell me what to do

Talk about what we care and take every talk seriously!
An Illustrative Guide to PhD

Imagine a circle that contains all of human knowledge:

By the time you finish elementary school, you know a little:

By the time you finish high school, you know a bit more:

With a bachelor's degree, you gain a specialty:

A master's degree deepens that specialty:

Reading research papers takes you to the edge of human knowledge:

Once you're at the boundary, you focus:

You push at the boundary for a few years:

Until one day, the boundary gives way:

And, that dent you've made is called a Ph.D.:

Of course, the world looks different to you now:

So, don't forget the bigger picture:

Keep pushing.

Matt Might
Preparation for PhD Dissertation

✓ Choose an area
✓ Choose a research topic
✓ Get to know your area

Do your research ……

☐ Manage your time
☐ Draft your thesis/dissertation
☐ Proofread and revise
☐ Prepare oral defense

Stay organized and go digitalized!
A Dissertation Should ...

- Have a **clear objective**, based on a well worked out thesis or central question
- Be **well planned** and **widely researched**
- Contain consistent and correct **referencing**
- Be structured and expressed in an appropriate academic way
- Show that you have a good grasp of relevant concepts and are able to apply them
- Show that you have been able to use this to produce a well argued extended academic work
How To Deal With New Challenges

*It is all about efficiency! Key: The right tools!*

- **Reference managers**
  - BibTeX, Mendeley, BibDesk, EndNote, …
- **Version control**
  - CVS, SVN, Git, Mercurial, …
- **Time management**
  - Calendar, Todo List, Gantt Chart, …
- **Cloud storage and sync**
  - DDL, Dropbox, Google Drive, iCloud, …
- **Integrated search engines**
- **Communication**
  - Skype/WeChat, WhiteBoard, TeamViewer, GoToMeeting, …
1. Organize your references
2. Prepare your slides/posters/CVs
3. Do version control and backup
When I Was A Student

- Go to the library to copy a paper
- File tons of papers in the office
- Try to remember which paper I need
- Find a paper in piles of papers
- File tons of papers in the office again
- Type in references by hand
- Prepare a webpage and CV
- Send email to a friend to get a paper

There is no such thing as too many books. There is only too little bookshelf!
Reference Management

- Check an interesting paper out
  Have I seen this paper before? Maybe ...
- Check who is interested in a paper
  How many downloads? Who’s citing it?
- Organize citations & generating bibliographies
  Don’t want to enter references over and over again!
- Managing your documents & references
  Soon you will have thousands of PDF files. How to find them?
- Sharing references with collaborators
  Sending PDF files to collaborators via email? Not good!
- Creating your publication profile
  Is your publication list up-to-date? No Way!
BibTeX Database

- O. Patashnik and L. Lamport, 1985
- User is freed from deciding how to format
- Easy to be reused in other documents
- Initialization overhead

An example given by H. Hudson, Berkeley

% The \cite command functions as follows:
% \citet{key} ===> Jones et al. (1990)
% \citet*{key} ===> Jones, Baker, and Smith (1990)
% \citep{key} ===> (Jones et al., 1990)
% \citep*{key} ===> (Jones, Baker, and Smith, 1990)
% \citep[chap. 2]{key} ===> (Jones et al., 1990, chap. 2)
% \citep[e.g.][p. 32]{key} ===> (e.g. Jones et al., p. 32)
% \citeauthor{key} ===> Jones et al.
% \citeauthor*[key] ===> Jones, Baker, and Smith
% \citeyear{key} ===> 1990
Key Features

- Free
- Fast search
- Organize
- Read and annotate
- Cite and write
- Cross platform support
- Client + web-based access
- Communicate
- Increase awareness
- Discover interesting papers
Mendeley Desktop

- Set up and manage your reference groups
- Library showing all your documents (citation or table view)
- Add tags & notes and edit document details
Access From Everywhere

You can also add references, edit and manage your library online.
You have different options to set up your library:

- Add single files or an entire folder
- “Watch a folder” to automatically import PDF files
- Drag and drop PDFs into Mendeley Desktop

... and Mendeley will try to extract the document details automatically.
Other Ways to Add Papers

- Add bib items automatically: watch folders!
- Add a bib item manually
- Use Mendeley Suggest: big data
- Drag and drop a PDF file to Mendeley
- Use quick-add buttons: arXiv, IEEE Xplore, …
- Import from other software: BibTeX, EndNote, …
- Sync with other services: Zotero, Citeulike, …
- Use the Research Catalog: >30M papers
- Import using the web importer
Manage Your Library

- Star your favorite papers
- Documents can be marked read/unread
- Filter by authors, tags, publications or keywords
- Open attached PDF files in integrated viewer
Search As Your Type
Multigrid and Gauss-Seidel Smoothers Revisited: Parallelization on Chip Multiprocessors

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ABSTRACT
Efficient solution of partial differential equations require a match between the algorithm and the target architecture. Many recent chip multiprocessors, CMPs (a.k.a. multi-core), feature low intra-thread communication costs and smaller per-thread caches compared to previous shared memory multi-processor systems. From an algorithmic point of view this means that data locality issues become more important than communication overheads. A fact that may require a re-evaluation of many existing algorithms.

General Terms
Algorithms, Performance

Keywords
Multigrid, Gauss-Seidel, Poisson equation, relaxation, orderings, cache blocking, OpenMP, temporal blocking, CMP

1. INTRODUCTION
Whenever there is a paradigm shift in computer architec
Adult bone-marrow-derived mesenchymal stem cells are immunosuppressive and prolong the rejection of mismatched skin grafts in animals. We transplanted haploidentical mesenchymal stem cells in a patient with severe treatment-resistant grade IV acute graft-versus-host disease of the gut and liver. Clinical response was striking. The patient is now well after 1 year. We postulate that mesenchymal stem cells have a potent immunosuppressive effect in vivo.

Lancet 2004; 363: 1439–41
See Commentary page 1441

Severe acute graft-versus-host disease (GVHD) after allogeneic stem-cell transplantation is associated with high mortality. Bone marrow contains pluripotent mesenchymal stem cells that form bone, cartilage, adipose tissue, and muscle. These stem cells are not immunogenic and escape recognition by alloreactive T cells and natural killer cells. Mesenchymal stem cells given intravenously have been well tolerated. Furthermore, they are immunosuppressive and inhibit the proliferation of alloreactive T cells. Preliminary reports of haemopoietic reconstitution and a reduction in the experience of graft-versus-host disease in recipients of bone marrow cells to treat haemopoietic failure raise the possibility of their use in GVHD prophylaxis.

A 9-year-old boy with acute lymphoblastic leukaemia in third remission received a transplant of blood stem cells from an HLA-A, HLA-B, HLA-DRB1 identical, unrelated, female donor after conditioning with cyclophosphamide (120 mg/kg) and fractionated total body irradiation (3 Gy for 4 days). Immunosuppression included thymoglobulin (6 mg/kg) during the conditioning, followed by ciclosporin combined with four doses of methotrexate. On day 11 after allogeneic stem-cell transplantation, the patient developed a maculopapular rash of the thorax and back that progressed despite treatment with prednisolone (2 mg/kg daily). By day 22, the patient developed diarrhoea (>1000 mL per day) and abdominal pain requiring morphine. He stopped eating on day 24. Bilirubin and alanine aminotransferase concentrations rose (figure 1). Psooralen and ultraviolet-A light (PUVA) treatment (two to three times per week) for 3 weeks was followed by extracorporeal PUNA (one to four times per week) for 6 weeks. Infliximab (10 mg/kg) and daclizumab (1 mg/kg) for 4 weeks were ineffective for the treatment of GVHD, including diarrhoea up to 20 times daily, and a bilirubin concentration of 250 mmol/L. He was treated for repeated bacterial, viral, and invasive fungal infections.

We chose the mother as donor, because she was readily available and because MHC- compatibility is not necessary for mesenchymal stem-cell immunosuppression. After ethics committee approval and informed consent, mesenchymal stem cells were isolated as previously described. Briefly, we isolated mononuclear cells from a bone marrow aspirate by Percoll gradient centrifugation (Sigma, St Louis, MO, USA). The cells were plated at a density of 3×10^6 cells per 175 cm² in polyethylene flasks in low glucose Dulbecco’s modified Eagle’s medium (Life Technologies, Gaithersburg, MD, USA), supplemented with 10% fetal...
Share With Your Collaborators

Groups can be private or public (invite only or open).

Public groups only have the reference details – no full text. Private groups contain the full text including notes & annotations.

View the group online – other users can request to join or simply follow the activity of the group.
Communicate with Collaborators

1. Create a private group
   Create a private group to share your draft dissertation and associated references with all of your advisors in one place.

2. Invite advisors and reviewers
   Invite your advisors and committee members to join so that everyone has easy access to all documents and references, all the time.

3. Track and respond to commentary
   Your advisors can annotate your draft, and you can respond in real-time - so much easier than keeping track of multiple responses!

1. Create a private group
   Create a private group on Mendeley to share PDFs and other documents with a group of your colleagues.

2. Add research and draft papers
   Create a library of research specific to your group and add it to the group folder.

3. Annotate/write papers together
   Share your thoughts with your colleagues and write papers collaboratively without having to constantly e-mail back and forth.

See more examples on http://www.mendeley.com/how-we-help/
Other Features

- In-application printing with annotation
- Advanced search options (title, author, abstract, …)
- Access from everywhere
- Personalized search results
- Analyze hot research topics
- Search special characters
- More storage space
- Fast web access

Better support for non-English documents?
So What?

- Go online and search a paper among millions of them
- Extend the search to people who is citing the paper
- Search a subject to write a paper or proposal
- Maintain a BibTeX library across all devices
- Cite a paper from the BibTeX library
- Search on laptop for a paper
- Not so many hardcopy papers in the office
- Share a paper with a collaborator easily
- Sometimes still ask a friend to find a paper
- Update my publication list automatically
1. Organize your references
2. Prepare your slides/posters/CVs
3. Do version control and backup
Keys to Prepare A Talk

- Provide appropriate acknowledgments
- Know your audience: adjust for different audience
- Less is more: Keep it simple, focus on key points
- Start your presentation strongly
- Make the audience want to learn more
- Time goes fast: Be ready to skip slides
- Q&A is as important as the talk itself
- Learn from the best (go to seminars)
- Practice and time your presentation
Lessons Learnt from Steve Jobs

Six Presentation Secrets of S. Jobs:
1. Present what you’re passionate about
2. Big picture first
3. Tell a story involving a villain
4. Bring numbers to life (5GB ~ 1000 songs)
5. Think visually
6. Be animated: use body language, visual aids, ...

- Good presentations are memorable
- Great presentations are motivating
- Good presentations contain valid information
- Great presentations contain minimal information
- Good presentations include stories
- Great presentations are stories
Tools for Making A Presentation

- PowerPoint/Keynote + LaTeXit/MathType
- TeX: Foil/Beamer/PowerDot, latexdiff
- Use a template!
  - Helps you to focus on the content
  - Gives you the possibility to easily create professionally looking slides
  - However, personalizes your slides!
  - Be careful with your user-defined macros
Beamer: Standard Templates

Berkeley

Berlin

Boadilla
Beamer: Personalized Templates

Eindhoven University of Technology style for Beamer \LaTeX
Show where you’re from

Pim Vullers MSc
p.vullers@cs.ru.nl
http://www.cs.ru.nl/~pim/

Department of Mathematics and Computer Science
Eindhoven University of Technology
the 1st example presentation 2010
4th May 2012

Quiz: Antwort

Quelltext

```java
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
public class QuizArray {
  public static void main(String[] args) {
    String[] myArray1 = {"geh", "du", "alter", "sack"};
    String[] myArray2 = myArray1;
    myArray2[0] = "sack";
    System.out.println("myArray1: ");
    for (int i = 0; i < myArray1.length; i++) {
      System.out.println(myArray1[i] + " ");
    }
    System.out.println("myArray2: ");
    for (int i = 0; i < myArray2.length; i++) {
      System.out.println(myArray2[i] + " ");
    }
  }
}
```

Ausgabe

myArray1: geh du alter sack
myArray2: geh du alter sack

CGBG Fire Fighting

- 3 Agents have to fight fires:
  - Each house is burning or not.
  - Actions are restricted to 2 nearest houses.
  - Observations: flames ("F") or not ("N")
    (for a observed subset of houses.)
  - Each house induces a local payoff function.
    - specified over subset of agents!
**Example of the tycja style**

Hendri Adriaens    Christopher Ellison

December 31, 2013

**Example of the husky style**

Hendri Adriaens    Christopher Ellison

December 31, 2013

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**Example slide**

Here is the binomial formula.

\[(a + b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k\]  

We will prove formula (1) on the blackboard.

- Here
  - is
    - a
    - list
    - with
  - seven
  - items.
CUPOSTER and RES Classes

AFEM@matlab
A MATLAB Package of Adaptive Finite Element Methods
Long Chen and Chensong Zhang
University of Maryland, College Park, MD, USA

Introduction
The finite element method (FEM) is one of the most
common and powerful numerical methods for the solu-
tion of many practical problems in engineering and
physics. Adaptive finite element methods (AFEMs) have
been introduced to reduce computational costs while
keeping optimal accuracy since 1990s. Incorrect FEM
approximation could cause great errors in practice.
In August 2001, an efficient oil platform, the Stenager A platform, in Norway sank in the North Sea
cost almost a billion dollars.
The post accident investigation result is due to incorrect finite element approximation.
Finite element courses are usually taught to engi-
neers and mathematics students in colleges. But the programming of FEM and AFEM is very
difficult and technical. AFEM@matlab is a package of numerical methods quickly due to its vast pre-obtained
library of fundamental functions and compact in-
teractive operations. The goal of AFEM@matlab is to provide more holding-bells of FEMs and
AFEMs in MATLAB.

Main Features
AFEM@matlab can be useful for both education and
research. The purposes of this package are two-fold,
- Education: to help students to understand the phi-
losophy and mechanics of standard finite element
methods, adaptive algorithms and finite element
solving tools.
- Research: to provide a unified standard adap-
tive algorithms and methods. Main features of this package include:
  - User friendly interface
  - Self-contained
  - Short and efficient
  - Large number of example to follow
  - Open source
  - Cross-platform
  - Consistent usage.

Fast Solvers
Multilevel adaptive solvers, like Multigrid methods
and polynomial multigrid preconditioners (PML) meth-
ods (see [2]), are usually used as a part of the adap-
tive algorithms for solving PDEs using a hierarchy of di-
vergence-free spaces, which can be applied in combina-
tion with continuous discretization schemes and strong
nonlinear solvers techniques known today. In this pack-
age, we implemented PML with several commonly
used multigrid precondititons. It has linear con-
mplexity and requires much lower memory space than
the direct solver in MATLAB.

Mesh Adaptation
Unlike other AFEM software, we do not record and
maintain the hierarchy anymore. Instead, we
store the hierarchy in a separate place and allow
excessive commands. All operations are optimized
using MATLAB's internal functions. In fact, run-
ing numerical tests show that our program can solve a simple Unix system command (e.g., "ls")
problem-accurately in a few seconds on a Linux/PC.

Adaptive Algorithm
After more than thirty years of extensive devel-
lopment, adaptive methods and multilevel FEM solvers
are now standard tools in scientific comput-
ing. Because of the importance of the adaptive dis-
cretizations techniques and fast linear system solvers,
both the error analysis and the computational algo-
rithm are beyond our reach.

Chensong Zhang
Curriculum Vitae

Chensong Zhang

Honors and Funding
2003  Plenary Speaker
  18th National Symposium on Numerical Methods in Fluid
2004  Plenary Speaker
  21st Intl. Conf. on Domain Decomposition Methods
2005  National Science Foundation of China
  http://en.esf.org.cn/PL
2006  Plenary Speaker
  Symposium on Computational Science, Engineering & Finances
2009  US National Science Foundation
  DMS-9515115, CP
2006  Dean Dissertation Completion Fellowship
  University of Maryland, College Park

Selected Publications
- On the global existence and uniqueness of solutions to discretized viscoelastic flow models with Y. Jia, L.L Xu
- A posteriori error analysis for a class of integral equations and variational inequalities with R. Nochetto & T. von Petersdorff
  Numerische Mathematik, 116 (2010)
- A coarsening algorithm on adaptive grids by newest vertex bisection and its applications with L. Chen
- A posteriori error analysis for parabolic variational inequalities with K.-S. Moon, R. Nochetto, & T. von Petersdorff
  ESAIM: M2AN, 41 (2009)

Download
This package is an open-source software under the
terms of the GNU General Public License. You can
please go to the following website for downloading
http://www.mathworks.com/products/matlab/

References
(1) Chen, C.S. and Zhang, C. Adaptive isotropic meshing
(2) Chen, C.S. and Zhang, C. A posteriori error estimators
(3) Chen, C.S. and Zhang, C. Adaptive mesh refinement
(4) Nochetto, R. A coarsening algorithm on adaptive grids by newest
vertex bisection (nabla, Lecture Notes in Computational
(5) Zhang, C. A posteriori error analysis for parabolic
(6) Zhang, C. Adaptive mesh refinement

1. Organize your references
2. Prepare your slides/posters/CVs
3. Do version control and backup
Distributed Version Control System

- CVS
- SVN
- Vesta
- Git
- Mercurial
- DCVS
- Fossil
- Monotone
An Example: Mercurial

c:\hginit> hg
Mercurial Distributed SCM

basic commands:

add       add the specified files on the next commit
annotate  show changeset information by line for each file
clone     make a copy of an existing repository
commit    commit the specified files or all outstanding changes
diff      diff repository (or selected files)
export    dump the header and diffs for one or more changesets
forget    forget the specified files on the next commit
init      create a new repository in the given directory
log       show revision history of entire repository or files
merge     merge working directory with another revision
pull      pull changes from the specified source
push      push changes to the specified destination
remove    remove the specified files on the next commit
serve     export the repository via HTTP
status    show changed files in the working directory
summary   summarize working directory state
update    update working directory
An extra copy does not hurt! Cloud, Time Machine, sync across computers, external hard disks, …
Theorem \cite{thm:two-grid-convergence} can be viewed as a special case of the X-Z identity in the case of space decomposition. According to \eqref{eq:xz17}, we get
\[
\begin{align*}
&-c_1 = \sup_{\|w\|_\infty} \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS} + c_1 - \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS}\|
\end{align*}
\]
We can prove that
\[
\begin{align*}
&-c_1 = \sup_{\|w\|_\infty} \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS} + c_1 - \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS}\|
\end{align*}
\]

Assumption \cite{Assump:MSC} is not easy to verify directly. So we now give a few useful estimates for the constants in the
\begin{itemize}
  \item \[\begin{align*}
  -c_1 = \sup_{\|w\|_\infty} \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS} + c_1 - \inf_{\{\text{substack}(w = v_c + v \| v_c \in V_c, v \in V)\}} \|v_c + cPi_c v\|_\infty + 2 + \|\overline{cS}\|
  \end{align*}\]
  
  Assume that, for any $v \in V$, there is a decomposition $v = \sum_{j=1}^{\infty} v_j$ with $v_j \in V_j$ satisfying
\end{itemize}
```plaintext
base/src/wrapper.c

<table>
<thead>
<tr>
<th>Line</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>dvector rhs, sol; // right-hand-side, solution</td>
</tr>
<tr>
<td>98</td>
<td>AMG_param angparam; // parameters for AMG</td>
</tr>
<tr>
<td>99</td>
<td>itsolver_param itparam; // parameters for itsolver</td>
</tr>
<tr>
<td>100</td>
<td>fasp_param_amg_init(&amp;angparam);</td>
</tr>
<tr>
<td>101</td>
<td>fasp_param_solver_init(&amp;itparam);</td>
</tr>
<tr>
<td>102</td>
<td>itparam.tol = *tol;</td>
</tr>
<tr>
<td>103</td>
<td>itparam.print_level = *ptrlvl;</td>
</tr>
<tr>
<td>104</td>
<td>itparam.maxit = *maxit;</td>
</tr>
<tr>
<td>105</td>
<td>angparam.print_level = *ptrlvl;</td>
</tr>
<tr>
<td>106</td>
<td>mat.row = *n; mat.col = *n; mat.nnz = *nnz;</td>
</tr>
<tr>
<td>107</td>
<td>mat.IA = ia; mat.JA = ja; mat.val = a;</td>
</tr>
<tr>
<td>108</td>
<td>rhs.row = *n; rhs.val = b;</td>
</tr>
<tr>
<td>109</td>
<td>sol.row = *n; sol.val = u;</td>
</tr>
<tr>
<td>110</td>
<td>fasp_solver_dcsr_krylov_amg(&amp;mat, &amp;rhs, &amp;sol, &amp;itparam, &amp;angparam);</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
<tr>
<td>111</td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>/**</td>
</tr>
<tr>
<td>113</td>
<td>* \fn INT fasp_wrapper_dbsr_krylov_amg (INT n, INT nnz, INT nb, INT *ia, INT *j</td>
</tr>
<tr>
<td>114</td>
<td>*             REAL *a, REAL *b, REAL *u, REAL tol,</td>
</tr>
<tr>
<td>115</td>
<td>*             INT maxit, INT ptrlvl)</td>
</tr>
<tr>
<td>116</td>
<td>* \brief Solve Ax=b by Krylov method preconditioned by AMG (dcsr -&gt; dbsr)</td>
</tr>
<tr>
<td>117</td>
<td>* \param n Number of cols of A</td>
</tr>
<tr>
<td>118</td>
<td></td>
</tr>
<tr>
<td>119</td>
<td>mat.row = *n; mat.col = *n; mat.nnz = *nnz;</td>
</tr>
<tr>
<td>120</td>
<td>mat.IA = ia; mat.JA = ja; mat.val = a;</td>
</tr>
<tr>
<td>121</td>
<td>rhs.row = *n; rhs.val = b;</td>
</tr>
<tr>
<td>122</td>
<td>sol.row = *n; sol.val = u;</td>
</tr>
<tr>
<td>123</td>
<td>fasp_solver_dcsr_krylov_amg(&amp;mat, &amp;rhs, &amp;sol, &amp;itparam, &amp;angparam);</td>
</tr>
<tr>
<td></td>
<td>}</td>
</tr>
</tbody>
</table>
```
Grad School Is Like Kindergarten

ALL DAY NAPPING IS ACCEPTABLE

THERE IS CONSTANT ADULT SUPERVISION

YOU GET COOKIES FOR LUNCH

MOST COMMON ACTIVITY: CUTTING AND PASTING

Source: http://www.phdcomics.com

PHD: Permanent Head Damage / Piled Higher and Deeper. Withdrawn from the real world, overworked, underpaid, stressed, and painfully uncertain about his or her life!
THANK YOU!