ICIAM03 minisymposia ICM 01₄N-04/5 on Advanced Collaborative and Visualization Environments (#1 and #2) 11.00-1.00 Wednesday and Friday in SHM3



Eight 25 minute presentations organized by J. Borwein, K. Polthier and J. Rodrigues





9,640



Colab.

Advanced Collaboration and Grid Computing

Jonathan Borwein, FRSC Canada Research Chair in IT Shrum Professor of Science

Simon Fraser University



Part I: The Simon Fraser CoLab

Tools of CoLab

5976

CERDERALS

- Users of CoLab
- □ The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)



66895597

RALS DE MII

SFU CoLab

www.colab.sfu.ca



mathematical science and computational science
science education and advanced publishing

Built to facilitate and study face-face and distant collaboration
heterogeneous, synchronous and asynchronous

- Cost of about 750K but a *Grid Station* or *Grid Room*
 - □ with commodity components can be built for 5K, 50K etc



XCI

1

-

SFU CoLab









SFU CoLab









CoLab_Tour.mov

SFU CoLab



- Part I: The Simon Fraser CoLab
 - **Tools of CoLab**

5976

CERDERAIS

- Users of CoLab
- □ The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

Tools of CoLab



6264626895597

EN MINDER ATS

\$97932384626433

RALS DE MIDDELLYN IS

Four 50" plasma screens and one 72" back projected screen
two conventional smart white boards
one plasma in table, one "portable"---can be tiled variously
all touch sensitive (soon optically)
can be written on and captured

HCI

Tools of CoLab

Connects to a 192 cpu Beowulf and 32 cpu COMPAC alpha
'top 500' machine in June 2002 (for \$250K)
run directly out of *Maple* or *Matlab*

All sorts of (research) HCI issues---some anticipated
prototype for IRMACS and for WestGrid



Tools of CoLab









CHULRAIS 314159265550

SNEL

-

Donnabon



3



10

- **D** Part I: **The Simon Fraser CoLab**
 - Tools of CoLab

5976

CERDERALS

- **Users of CoLab**
- □ The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

Users of CoLab

626892597

IDDELLYN IS

SHIC



□ All levels and many disciplines (can squeeze in 30 users)

- □ grade four through `infinity'
 - naïve and sophisticated
 - peer-to-peer and one-many

Many uses

JMB

□ Research "proofs and refutations"

proof reading, brainstorming



Users of CoLab

G grant writing, business meetings

- Teaching
- Outreach

Many partners

vendors, private sector, government, academic



The Life of Pi

Friday · 14 March 2003 · Simon Fraser University · CoLab · www.colab.sfu.ca/PiDay/ · 604.291.5615

Lectures by World Experts

The Life of Pi - Jonathan Borwein Knots in Action - Rob Scharein



Reception for All

All kinds of Pies **Donuts and Pretzels** T-shirts



Demos for Budding Scientists and their Teachers

Come check out a new state-of-the-art research lab for collaborations at SFU.

CoLab Technologies: Smart Boards and Access Grids Mathematical Software - Virtual CoLab - Mathematical Learning Objects - Hands-on Sessions







Users of CoLab





BE MANY PARA

CHUERATS 314159255550







Users of CoLab

ņ

1

1000

at.

and to the Sue

	a	KD.M	-	Square .
- L	/	200	1111	and a
	-	-		in the
	Repla	-		

and College Mary 11.03 and Co		lie in	en 14
And Channell Load Hory 21-52 And Channell Load Hory 21-52 And Annual Hory 21-52 Annual	and the second second	Mary .	
	and investigation of the local division of t	Mark	1942
	sept Sheet Lines	Met	1111
		111	T Jule
		200	14 H
Marine Marine 141 (111)		141	12-18
Same Diane	and the	101	144
Market State	and the second second	Print Disager	- L
States		- Anger	
the second se	The Real Property lies of the local division		(Brite
and the second se	a second second second	and the second second	
These is pade	The states	Radio Destaurante	
The state of the second st	and then it.	Bernham - i far f	
Descent of the local of the loc	Contract of Contractor	Personal Property lies:	1.0
and the second se	The second se	and the second se	

D Part I: **The Simon Fraser CoLab**

Tools of CoLab

5976

CERDERAIS

- Users of CoLab
- **The SAMPLE project**
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

For Education Day

SAMPLE Education Project



sample.colab.sfu.ca



Funded by Canada's *Initiative on New Economy:* (Sample) **Advanced Mathematically Productive Learning Environment**

- □ built from ground up---content for a digital age
- based on Learning Object Repository principles paper and scissors, spaghetti, chat-rooms and applets • "Contemporary look and feel"
- Software & hardware explorations---cognitive styles

• e.g., MathPads

Interactive Dictionary



Partnered by CECM spin-off MathResources is building commercial counterpart (3 year project with "regional development money")
















000	Unit 1 - Shape and Space	
	X 🕹 🖞 🖉 🖾 🛍	
Address III are //w	anti inter mome i Autoria mon saar	
Clashing for C	And Game Servert Game Stree Grant Grant Street Harton College for Hart	La Ora
Choose V	ar Lesson	and generation of the second sec
Basic Enric D-Series E-Se D1 D2 + E2 D3 + E3		
Lesson D3	ARE YOU READY?	
Naming and	and the state of	
Polygons	1) How many unique triangles can you	
-	make if you are told the lengths of the three sides?	
8	a) 1 (O)	
i ind	b) 2	
	c) 3	
	d) 4	
2	e) as many as you like	
Play	2) Which of the following sets of side	
E Tab Thursday	a) 3.4.5	
a C tak through	b) 2.2.4	
Are You Ready?	x) 2,3,4	
Now Did You Date	d) 2,2,5	
Look Back	e) 1,5,5	
Parents' Notes	3) Which one of the following	
	a) even sight triangle is increase.	
it Teachers' Den	b) every excilateral triangle is	
E Share Ideas		
H Teachers' Den H Share Ideas	isosceles	
18 Teachers' Den 18 Share Ideas 18 Help	isosceles c) every isosceles triangle is equilateral	
E Teachers' Den E Share Ideas E Help	c) every isosceles triangle is equilateral d) every isosceles triangle is scalene	
E Teachers' Den E Share Ideas E Help	isosceles c) every isosceles triangle is equilateral d) every isosceles triangle is scalene e) every scalene triangle is equilateral	
E Teachers' Den E Share Ideas E Help	isosceles isosceles triangle is equilateral d) every isosceles triangle is scalene e) every scalene triangle is scalene e) every scalene triangle is equilateral Which of the following is a property	
E Teachers' Den E Share Ideas B Help	isosceles isosceles triangle is equilateral d) every isosceles triangle is scalene e) every isosceles triangle is scalene e) every scalene triangle is equilateral Which of the following is a property of right triangles?	
E Teachers' Den E Share Ideas B Help	isosceles isosceles triangle is equilateral d) every isosceles triangle is scalene e) every scalene triangle is scalene e) every scalene triangle is equilateral 4) Which of the following is a property of right triangles? a) all sides are equal	
E Teachers' Den E Share Ideas B Help	isosceles isosceles triangle is equilateral d) every isosceles triangle is scalene e) every scalene triangle is scalene e) every scalene triangle is equilateral d) Which of the following is a property of right triangles? a) all sides are equal b) all angles are equal c) one interior angle is 90°	

a betartat gana

4



a hiternet zone



3 internali 2008

000	Unit 1 - Shape and Space	
A Back Ferment	X 😳 📅 🖉 🚟 🔤 Stop Refrest Home Autofili Print Mail	1
Q 1 ha Mare Day 0	ergie onlei staan bezelen / Annie - O Annie Sonnet - O Annie Store - O Zurek - O Han 1953 - O Hanner Hindonies - O 1956 en Hanneskon - O Hills	
Choose Y Basic Enric D-Series E-Se O1 E1 D2 E2 O3 T E3	hment Extra	
Lesson D3	CHAT-N-TIME	3 user currently online. Chatteen time:: 7/4/03 15:02:52
Classifying Polygons	Welcome to the Chat Room!	Username Idle since student 7/4/03 15:02:43
Craphone Complete	Type /help for a list of options.	Lupdate Who's Online]
Page 1	[7/4/03 15:02:43] student: Triangles are fun. [7/4/03 15:02:19] student: student: Student: Studen	
E Talk Through	Chetroom unused.	
E Teachers' Den		
Chat-N-Time WWW Boart E Nelp		
	Talk to us, student!	

XCI

d Sino Refresh Home AutoFill Print Mall 17/Jangle-sold-shushmin/ © Apple © Apple Support © Apple Shore © Stock © Hiel OS X © Hersont Hielitige © Office for Hielitight © HSN	
O Appe O Appe Deport O Appe Three O Taxis O Har 05 X O Har Hart Hartingte O Office for Hardwith O HDR	
e Your Lesson nrichment Extra Est Est Fi Est Est Fi Est Est Fi Est Est Est Est Est Est Est Est Est Est	
(Post Message] [FAQ]	
 nosh - nosh 16:46:20 03/04/03 (0) Testing - Joe 12:35:11 03/03/03 (0) Testing from the Hill - Another Test 08:26:16 03/03/03 (0) Cute boy - Goober 20:50:15 03/02/03 (0) Pretty Nice Day - New Person 20:22:39 03/02/03 (0) Add some More - Helper 20:20:46 03/02/03 (1) 	
 <u>Not Adding Time</u>, - Adding Some More 20:11:41 03/02/03 (0) <u>adding - adding 16:17:03 03/02/03 (0)</u> <u>adding - adding 16:15:55 03/02/03 (0)</u> <u>adding - adding 16:15:55 03/02/03 (0)</u> <u>testing again</u> - another test 16:08:38 03/02/03 (0) <u>testing again</u> - another test 16:08:38 03/02/03 (0) <u>test - test 16:07:34 03/02/03 (0)</u> <u>test - test 16:07:34 03/02/03 (0)</u> <u>test - test 16:07:34 03/02/03 (1)</u> <u>test - test 16:07:37 03/02/03 (1)</u> <u>AccTrest 4</u> - Whoami 16:03:10 03/02/03 (0) 	
+ Cosi - Jen 15:18:54 03/01/03 (1) + <u>Se: Cool</u> - J Chang 15:22:18 03/01/03 (0) + <u>Testing2</u> - Rob B 14:51:49 03/01/03 (0) + <u>Testing</u> - Rob Ballantyne 14:50:22 03/01/03 (0) Post A Message!	
Name: E-Mail: Subject:	
	Image:

1

10

Part I: The Simon Fraser CoLab

Tools of CoLab

5976

CERDERALS

- Users of CoLab
- □ The SAMPLE project
- **The Virtual CoLab**

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)









Built on Muse an avatar based "chat room" software

provides "plug and play" design

415976

- affords good architectural metaphors
- □ yields 3D navigation with live interfaces
- □ client needs only free plugin on a PC



/irtual CoLab

``The most prominent requisite to a lecturer, though perhaps not really the most important, is a good delivery; for though to all true philosophers science and nature will have charms innumerably in every dress, yet I am sorry to say that the generality of mankind cannot accompany us one short hour unless the path is strewed with flowers.''

Michael Faraday





Part I: The Simon Fraser CoLab

Tools of CoLab

5976

CERDERAIS

- Users of CoLab
- The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

PART II

16852597





Obvious issues include cost and when to use

- **3D** or 2D?
- □ Passive or Active?
- □ Local or distant delivery?
- Precomputed or real-time?
- □ "Shock and awe" or shared?



lisualizatio/

Sound quality is often more of an issue for collaboration

Have used Rob Scharein's KnotPlot and Konrad Polthier's JavaView as prototypes for mathematical visualization tools

Passive to Active



Passive to Active

Visualization

657589

10

Math in the Cave

Helaman Ferguson

Visualization

er.Xt

Popularization

76 WISSENSCHAFT

Visual Mathematics Current Research, Sensual as Hollywood Cinema

and in the second

Splendid Ideas, Brilliantly Converted into Pictures

Mathematics can be piete fal. Computers out count have that there shows a which an parks

hard of contact of Taxan

the show he had again the sist of the side the sear other and peer has be parallel Antonio (and product 10% of the same of all most limits a strength of the same of the same manufacture of the same of the s ine first thread after that togel.

CONTRACTOR sort, statu for the first and then the stand is service. I stime bird in of the two problem for a maintenance

the signt its the -du- and Then to be participated and an participated and an an an and

Zeros of a Polynomial

al a word the operating (parameters in the sec it is a start the second set of the

65 Strange Positions

Lawrence resolution of 1

administration of the state of the second

Does this Figure Exist?

the presence of the second sec a first draub conduct a metano

(c) S. and of the spin P. for control of pa-ministry have been been as a particular management of particular manageme stars H.J. do | designed, we descent a standard

Glittering DNA Molecule

By headlorder are or structure tranging man ident a lotter body

apper its dualities have be Pictures from Sound

Chaos with Structure

an 'te' to be but taken ... and the presence where hering t

and story of Laboratory

How to Turn a Sphere Inside Out

Visualization

of oth instantiant (of some set that is and other? The & larges. | Mania second that of and a sub-the state of the state

tort of the second seco

35 Million Balls

Shocks Make Wayes to to the present i constraint on and

77

Molecular

Ballet

76 WISSENSCHAFT

manine alleges second the cases of a 77

Molekulares

Ballett

Visuelle Mathematik Alexedle Forschurgt, similich wie Kino aus Hollywood

and Parallel

the standard in the

in this of siles

to be a state of the state of t

- United

and a latter state of the state of sie

制作词

In such a dis 1

CHOLERATS 31415925

Glänzende Ideen, brillant ins Bild gesetzt

Nu triangling and the set of the transmission in the set of the se Malerall Space Midual with Dor Completes thing these To be a set of the set ball Gifts or puch Billion its Branks and

the property lies total all be also from rite erer Koslei Dorren lete Stende sider autge, duit der the post line tool make shallow -inducer all toris car centre interiorante internatione generatione lange

Nullstellen eines Polynoms

Munitico andre inclusion andre Ade, webb, Diege inclusion full and andre and their Borne and an and the state Die führung die Nationfen der

65 seltsame Distantion of the local distance of the loca in war and Stellen

the Carl state table then it's behalter And a second sec 1211 and the party

Gibt es diese Figur?

States States and in the second have been given the bar and the second state State I and State

 Alternative an appendix an appendix an appendix an appendix and a search and a search

The put makes in the put makes and a second or the put makes and the put makes and the put makes and the the put makes and the pu

Glitzerndes Erbmolekül

Warmshell facilities sales in the second

Chaos mit

Schocks machen Wirbel

to soft and Sectionseparate for a set community with an end and and an

Visualization

Struktur lates his is a rear of a

in sittinge files the s

Wie man eine Kugel umkrempelt

part when David when Rel at 2 Martin Agenesista der Martin auf Schumenken, an Stellt mit Anderen, and Stellt m ar Sind on Adulta, and Barton S. and Sampling Sampling

Bilder aus Schall

BILDERT ALLS SCENAIL Westwiss or a line or a production with the or NAME NO IN

35 Millionen Bälle

Virtuelles Atzen

Part I: The Simon Fraser CoLab

Tools of CoLab

5976

CERDER ALS

- Users of CoLab
- □ The SAMPLE project
- The Virtual CoLab

Q Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

Interdisciplinary Research in the Mathematical and Computational Sciences (IRMACS)

Interdisciplinary Research in the Mathematical And Computational Sciences

- □ Building on CoLab and CECM experience
- Pure and applied project based <u>research centre</u> with groups in …
 - Genomics and Proteomics
 - □ Statistical Epidemiology
 - National Diabetes Network
 - WestGrid HPC
 - Computational Fluid Dynamics
 - Experimental Mathematics
 - Rich Media
 - MITACS NCE and PIMS

Opens Sept 04

92659589

WEST ELEVATION

IRMACS

EAST ELEVATION 1:300

APPLIED SCIENCE BUILDING EXPANSION SIMON FRASER UNIVERSITY

IRMACS

Panoram



CHOLE AIS 314159265550



IRMACS

Stantec

Contraction of the local data

fatigitary -----

1.1 . b LAB LAB R 2 6

IRMACS

CHOLERAIS 314159255550





The Lot of EXETING BUILDING ADDITION/RENOVATION

CADERATS 31415925555





.

۲

9000 LEVEL RCP



IRMAC

10000 LEVEL FLAN

SIMON FRASER UNIVERSITY





Part I: The Simon Fraser CoLab

Tools of CoLab

5976

CERDERALS

- Users of CoLab
- The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

High Performance Computing



666689559

www.hpc.sfu.ca

High Performance Computing

□ Three (small) SFU prototypes for WestGrid

- □ 192 cpu (home built Athlone) **Beowulf cluster** being cloned
- **32** cpu COMPAC alpha clump
- □ 8 (+48) cpu SGI Origin SMP



□ Single image login, file management etc

□ SFU has 3 geographically separated locations

all with high tech programs

and immersive resources (making for a fine test-bed)





High Performance Computing



сомряд	
The second se	
THE REAL PROPERTY AND ADDRESS OF THE PARTY O	
The second se	
THE REAL PROPERTY AND ADDRESS OF THE REAL PROPERTY	
The second secon	-
THE REAL PROPERTY AND A PARTY OF THE REAL PROPERTY AND A PARTY OF THE	
A SOL CONTRACTOR OF THE OWNER	
ACCOUNT OF THE REAL PROPERTY O	
	2
	÷
respondence concentration	a.
	ē.
	÷
	ē
	ž
ISSESSED AND ADDRESS	÷
ADDRESS CONTRACTOR	5
	÷
The second secon	
testedddoo	5
A R. P. Bullette and an and a second s	
	-
NORTH CONTRACTOR AND	
NAME AND ADDRESS COLOR PROPERTY AND	
	-
NORTH AND	
And a second sec	
Additional instances of the Pa-	
The rest of the re	
THE OWNER OF TAXABLE PARTY OF TAXABLE PARTY.	

COMPAG

The subscription of the su	
Contraction in the second second	5
STREET, STREET	
and the second se	2
THE OWNER AND A DESCRIPTION OF	
CONTRACTOR OF CONTRACTOR AND	
CONTRACTOR AND A STORE OF THE	
COLUMN DESIGN AND ADDRESS OF ADDR	
The second s	
PARLANCE & DESCRIPTION	
Exception of the second s	
Concerned on the local division of the local	
- Print and a state of the stat	
the second se	
CONTRACTOR OF THE OWNER OWNER OF THE OWNER OW	
the second	
20100321 010000000	
Contraction and and a second s	
	_
erererer fateralas	
ATATATAT TATATATA	
TATATATA ATA ATATATATA	
0202020202020202020	
#2#2#2#2 2#2#2#2#2#2#	
CONTRACTOR DESCRIPTION OF THE	
eleisisi isisisisis	
#2#2#2#2 2#2#2#2#2#2#	
other Designation of the local division of t	
CONTRACTOR OF THE OWNER OWNER OF THE OWNER	
CONSISTING AND DESCRIPTION OF	

-

High Performance Computing

сомрла.

D Part I: **The Simon Fraser CoLab**

Tools of CoLab

5976

CERDERALS

- Users of CoLab
- The SAMPLE project
- The Virtual CoLab

Part II: Visualization and Computation

- Visualization Tools
- IRMACS an Interdisciplinary Research Centre for the Mathematical Sciences
- High Performance Computing in the Mathematical Sciences
- WestGrid (Grid Computing)

Grid Computing





WestGrid Resources (MOUSE OVER LOCATIONS TO SEE RESOURCES)

WESTERID LOCATIONS CA*net4 (GIGAPOP)

www.westgrid.ca



DAN

626895597

0000000

000000

SRALS D

ALS

A **\$50M** Canadian compromise

High Performance Computing

- □ Large SGI shared memory system (256cpu SMP)
- Cluster of COMPAC multi-processors (144cpu CluMP)
- IBM Commodity Cluster (1500cpu)

Distributed Storage

flexible acquisition strategies

□ local (25TB) and centralized (30TB+100TB)

Grid Compu

research storage wide area networks (Yotta Yotta BigBandWidth)

Collaborative Environments

GridRooms, GridStations and ACE's

Grid-collaboration (AccessGrid) and visualization

Access Grid

Grid Computing

0.231.1.5	A/S0258			5.
and a	I mare	F color	info	
1-5	Colub Audience Joodgr 42 Set 12 1school D1a 0 Res (0%)			-

ar XCI

-15926

Image
Image
Image
Image

New MC MARK
Mark
Mark
Mark

25 Mark
CO Mark
(DNu)

Image
Image
Image

Image
Image

DOME LO DO ADON - DOMA

T 100 5 -10

STREET, STREET

3

-Rengon University AUDIENCE2 9.71/s 60 kb/s (2.8%) V moler T restet CoLub Streaker root/0142.58.12.168/h261 OUs Obpa (CM) -----Timute Fredor WWWMIC PRESENTER PRESENTER 251/s 2716/h (ONL) make UALN VHOIAG AUDIERCE AUDIENCE 251/2 25 kb/2 10544 Finute Freedom WALR VED/AG PRESENTER

PRESENTER 25 Mil 25 Mars 10Mg

Col Mi Audienan Heidigeal An Alternan







Grid Computing



10

Grid Computing



49

Come and visit www.colab.sfu.ca

616845597

EN MINDER ATS

RALS DE MIDDELLYN IS

SHIESIN

3238462643385279502×

and so the end

