Piecewise Holistic Autotuning of Compiler and Runtime Parameters Reports

TABLE I TEST ARCHITECTURES OF THE PAPER.

	Ivy Bridge	Sandy Bridge
CPU	i7-3770	E5
Frequency (GHz)	3.4	2.7
Sockets	1	2
Cores per socket	4	8
Threads per core	2	2
L1 cache (KB)	32	32
L2 cache (KB)	256	256
L3 cache (MB)	8	20
Ram (GB)	16	64

TABLE II CODELET EXPLORATION OF OPENMP THREADS AFFINITIES ON SANDY BRIDGE

Benchmarks	Regions	Invocations	Accuracy	Acceleration	Coverage
BT	xsolve	201	92.33	4.96	35.4
	ysolve	201	96.7	4.54	28
	zsolve	201	97.07	3.99	29.7
	rhs	201	95.68	18.71	5.7
CG	conjgrad@405	400	72.71	1.46	71.1
	conjgrad@551	16	95.48	0.8	24.6
FT	cffts1	8	95.54	1.7	21.2
	cffts2	8	94.25	1.68	23.8
	cffts3	8	96.5	1.18	22.9
	evolve	6	82.06	0.94	14
	indexmap	2	79.76	5.59	18.1
IS	main	1	95.2	0.35	71.4
	rank	11	93.77	2.86	27.6
SP	xsolve	401	96.24	20.03	28.3
	ysolve	401	97.11	20.25	27.7
	zsolve	401	98.98	18.95	38.1
	rhs	402	98.37	28.12	5.6
LU	ssor	250	99.51	12.45	81
	rhs	251	96.79	12.73	18.7
EP	main	1	99.31	0.25	99.7
MG	resid	42	93.78	0.52	52.7
	psinv	40	94.32	0.57	16.2
	interp	35	87.06	0.53	8.9
	zero3	39	78.27	0.5	7.4

The **accuracy** of the codelet prediction is based on the relative difference between the original and the replay execution time. The **acceleration** is the exploration time saved when studying a codelet instead of the whole application. **Invocations** display the number of times a region is called inside the application. Only regions covering more than 5% of the application execution time are selected.

TABLE III
CODELET EXPLORATION OF COMPILER PASSES ON IVY BRIDGE

Benchmarks Regions Invocations Accuracy Acceleration Coverage BT xsolve ysolve zolv 201 98.65 102.17 25.2 ysolve zsolve 201 98.44 99.54 27.3 CG conjgrad@491 conjgrad@607 16 99.07 3.02 88 FT appft conjgrad@607 16 94.44 7.65 9.6 FT appft fft3d@152 8 98.18 3.84 27.6 fft3d@112 8 99.37 4.91 26.8 fft3d@112 8 97.85 4.2 30.6 evolve 6 98.94 5.84 7.8 IS rank createseq 1 97.94 0.38 60.0 fullverify 1 97.92 1.24 15.2 SP xsolve 401 99.71 161.67 11.2 ysolve 401 99.32 152.25 17.4 rhs@273 402 98.36 154.97 10.8	-					
VSOIVE 201 98.44 99.54 27.3	Benchmarks	Regions	Invocations	Accuracy	Acceleration	Coverage
Zsolve 201 98.13 98.55 27.1	BT	xsolve	201	98.65	102.17	25.2
CG conjgrad@491 conjgrad@607 16 sq.444 99.07 sq.6 3.02 sq.6 88 sq.6 FT appft sq.6607 1 sq.6 94.44 sq.6 7.65 sq.6 9.6 FT appft sq.6 1 sq.6 94.44 sq.6 7.65 sq.6 9.6 FT appft sq.6 1 sq.6 98.18 sq.8 3.84 sq.6 27.6 sq.6 fft3d@152 sq.6 8 sq.8 99.37 sq.9 4.91 sq.6 26.8 sq.9 fft3d@112 sq.6 98.94 sq.9 5.84 sq.9 7.8 IS rank sq.6 11 sq.9 91.64 sq.9 3.91 sq.6 21.6 sq.6 SP xsolve sq.1 sq.9 1 sq.9 4 sq.9 3.91 sq.6 21.6 sq.6 SP xsolve solve sq.1 sq.9 401 sq.9 99.71 sq.6 16.67 sq.6 11.2 sq.6 ysolve solve solve sq.0 401 sq.9 99.32 sq.6 154.97 sq.6 10.8 sq.6 rbs@273 sq.0 401 sq.2 96.02 sq.6 159.07 sq.5 sq.6 159.81 sq.9 LU buts sq.6 15500 sq.2 sq.6 159.81 sq.9 18.5 sq.6 <th></th> <th>ysolve</th> <th>201</th> <th>98.44</th> <th>99.54</th> <th>27.3</th>		ysolve	201	98.44	99.54	27.3
The conjgrad Conjg		zsolve	201	98.13	98.55	27.1
FT appft	CG		16	99.07	3.02	88
MG MG MG MG MG MG MG MG		conjgrad@607	16	94.44	7.65	9.6
SP Solve 401 99.71 161.67 11.2	FT					
SP xsolve 401 99.71 161.67 11.2 15.2						
evolve 6 98.94 5.84 7.8 IS rank createseq full verify 11 91.64 3.91 21.6 SP xsolve ysolve 401 99.79 1.24 15.2 SP xsolve ysolve 401 99.71 161.67 11.2 ysolve 401 99.02 149.29 16.3 zsolve 401 99.32 152.25 17.4 rhs@273 402 98.36 154.97 10.8 rhs@166 402 96.02 159.07 8.5 rhs@166 402 95.6 159.81 8.9 LU buts 15500 93.23 8.75 18.2 jacu 15500 94.02 37.07 14.4 blts 15500 94.91 8.75 17.8 jacld 15500 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@273 251 94.97 162.35 8.2<						
Section Sect						
createseq fullverify 1 97.94 0.38 60.0 SP xsolve ysolve 401 99.71 161.67 11.2 xsolve ysolve 401 99.02 149.29 16.3 zsolve 401 99.32 152.25 17.4 rhs@273 402 98.36 154.97 10.8 rhs@166 402 96.02 159.07 8.5 rhs@166 402 95.6 159.81 8.9 LU buts 15500 93.23 8.75 18.2 jacu 15500 94.02 37.07 14.4 blts 15500 94.91 8.75 17.8 jacld 15500 94.91 8.75 17.8 jacld 15500 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@273 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3		evolve	6	98.94	5.84	7.8
fullverify 1 97.92 1.24 15.2 SP xsolve ysolve 401 499.71 161.67 11.2 ysolve 16.3 zsolve 401 99.02 149.29 16.3 ysolve 16.3 zsolve 401 99.32 152.25 17.4 ysolve 17.4 ys	IS	rank	11	91.64	3.91	21.6
SP xsolve 401 99.71 161.67 11.2 ysolve 401 99.02 149.29 16.3 zsolve 401 99.32 152.25 17.4 rhs@273 402 98.36 154.97 10.8 rhs@64 402 96.02 159.07 8.5 rhs@166 402 95.6 159.81 8.9		createseq	1	97.94	0.38	60.0
ysolve 401 99.02 149.29 16.3 zsolve 401 99.32 152.25 17.4 rhs@273 402 98.36 154.97 10.8 rhs@166 402 96.02 159.07 8.5 rhs@166 402 95.6 159.81 8.9 LU buts 15500 93.23 8.75 18.2 jacu 15500 94.02 37.07 14.4 blts 15500 94.91 8.75 17.8 jacld 15500 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@64 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP main 1 82.8 0.24 98.4 MG interp 35 97.37 1.55 8.0 rprj3 35 96 0.3 6.0		fullverify	1	97.92	1.24	15.2
Zsolve	SP	xsolve		99.71	161.67	11.2
rhs@273 402 98.36 154.97 10.8 rhs@64 402 96.02 159.07 8.5 rhs@166 402 95.6 159.81 8.9 LU buts 15500 93.23 8.75 18.2 jacu 15500 94.02 37.07 14.4 bits 15500 94.91 8.75 17.8 jacld 15500 94.91 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@64 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP main 1 82.8 0.24 98.4 MG interp 35 97.37 1.55 8.0 rprj3 35 96 0.3 6.0 resid 42 96.5 0.29 48.3		ysolve	401	99.02	149.29	16.3
rhs@64 rhs@166 402 402 96.02 95.6 159.07 159.81 8.5 8.9 LU buts jacu blts jacu blts 15500 15500 94.02 93.23 37.07 14.4 14.4 blts jacld ijacld rhs@166 15500 251 94.91 93.45 8.67 8.67 15.2 15.2 164.73 8.0 8.0 8.0 164.73 8.0 8.0 8.2 170.11 162.35 8.2 170.11 8.2 8.2 170.11 8.2 8.2 170.11 8.2 8.2 170.11 8.2 8.2 170.11 8.2 8.2 170.11 8.2 8.2 170.11 8.2 8.2 8.2 170.11 8.2 8.2 8.2 8.2 8.2 8.2 8.2 8.2 8.2 8.2				99.32	152.25	17.4
rhs@166 402 95.6 159.81 8.9 LU buts jacu jacu 15500 93.23 8.75 18.2 blts jacu blts 15500 94.02 37.07 14.4 blts 15500 94.91 8.75 17.8 jacld 15500 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@273 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP main 1 82.8 0.24 98.4 MG interp rprj3 35 97.37 1.55 8.0 resid 42 96.5 0.29 48.3						
LU buts 15500 93.23 8.75 18.2 15500 94.02 37.07 14.4 15500 94.91 8.75 17.8 15500 94.91 8.75 17.8 15500 94.91 8.75 17.8 15.2 15.2 164.73 8.0 15.2 164.73 8.0 16.2 16.3						
jacu blts 15500 94.02 37.07 14.4 blts 15500 94.91 8.75 17.8 jacld 15500 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@64 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP		rhs@166	402	95.6	159.81	8.9
blts 15500 94.91 8.75 17.8 15500 93.45 8.67 15.2 15.2 164.73 8.0 15.2 164.73 8.0 16.2 16.35 8.2 16.35 8.2 16.35 16.3	LU	buts	15500	93.23	8.75	
jacld rhs@166 251 93.45 8.67 15.2 rhs@166 251 95.22 164.73 8.0 rhs@64 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP						
rhs@166 251 95.22 164.73 8.0 rhs@64 251 94.97 162.35 8.2 rhs@273 251 97.26 170.11 6.3 EP main 1 82.8 0.24 98.4 MG interp rprj3 35 97.37 1.55 8.0 resid 42 96.5 0.29 48.3						
rhs@64 rhs@273 251 251 94.97 97.26 162.35 170.11 8.2 6.3 EP main 1 82.8 97.37 0.24 1.55 98.4 MG interp rprj3 resid 35 42 42 96.5 96.5 0.3 0.29 6.0 48.3						
rhs@273 251 97.26 170.11 6.3 EP main 1 82.8 0.24 98.4 MG interp rprj3 rprj3 resid 35 resid 97.37 resid 1.55 resid 8.0 resid 42 96.5 0.29 resid 48.3						
EP main 1 82.8 0.24 98.4 MG interp rprj3 rprj3 resid 35 resid 97.37 resid 1.55 resid 8.0 resid 42 96.5 0.29 resid 48.3						
MG interp 35 97.37 1.55 8.0 rprj3 35 96 0.3 6.0 resid 42 96.5 0.29 48.3	-	rhs@273	251	97.26	170.11	6.3
rprj3 35 96 0.3 6.0 resid 42 96.5 0.29 48.3	EP	main	1	82.8	0.24	98.4
resid 42 96.5 0.29 48.3	MG	interp				
psinv 18 97.09 0.47 22.0						
		psinv	18	97.09	0.47	22.0

The **accuracy** of the codelet prediction is based on the relative difference between the original and the replay execution time. The **acceleration** is the exploration time saved when studying a codelet instead of the whole application. **Invocations** display the number of times a region is called inside the application. Only regions covering more than 5% of the application execution time are selected.