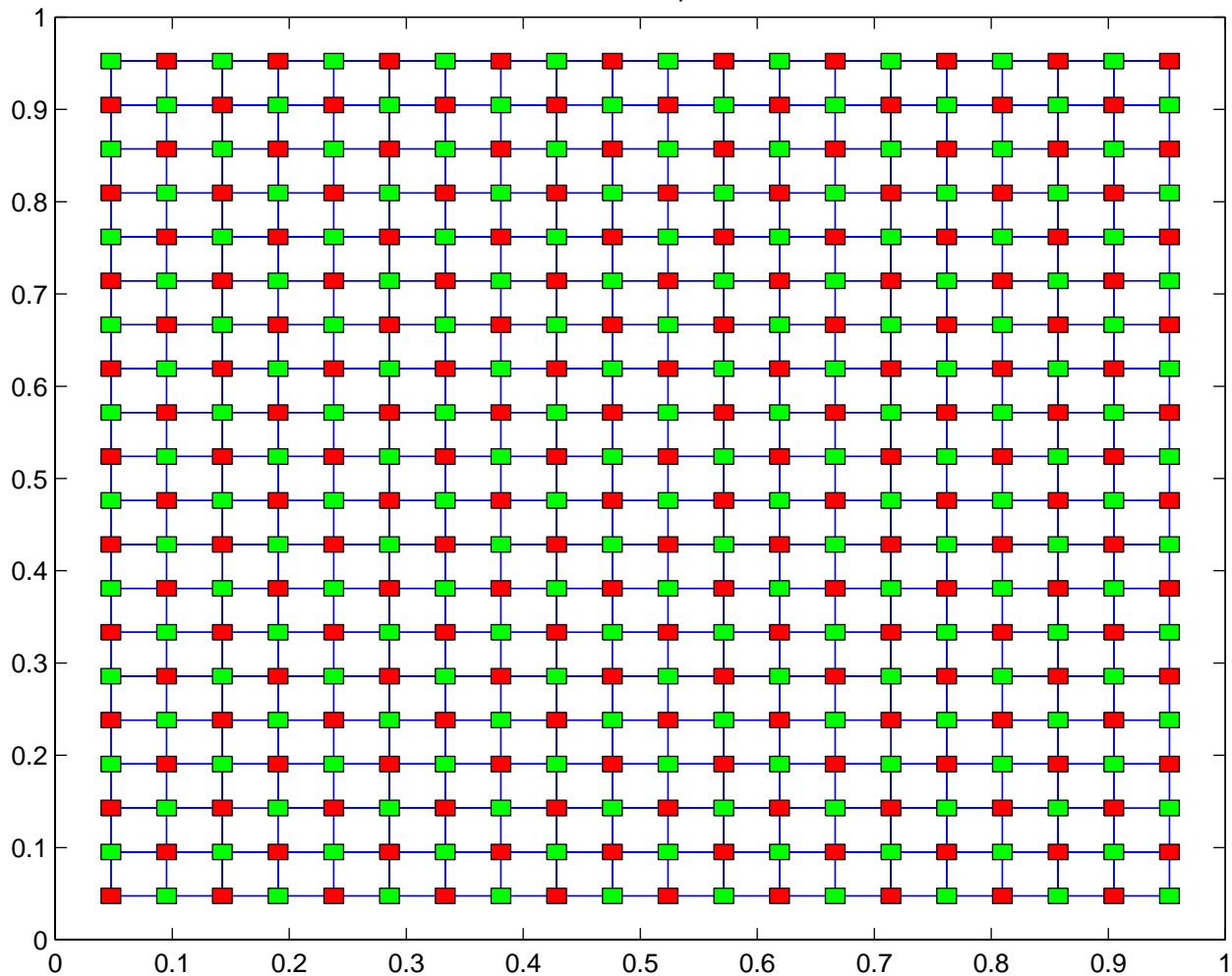
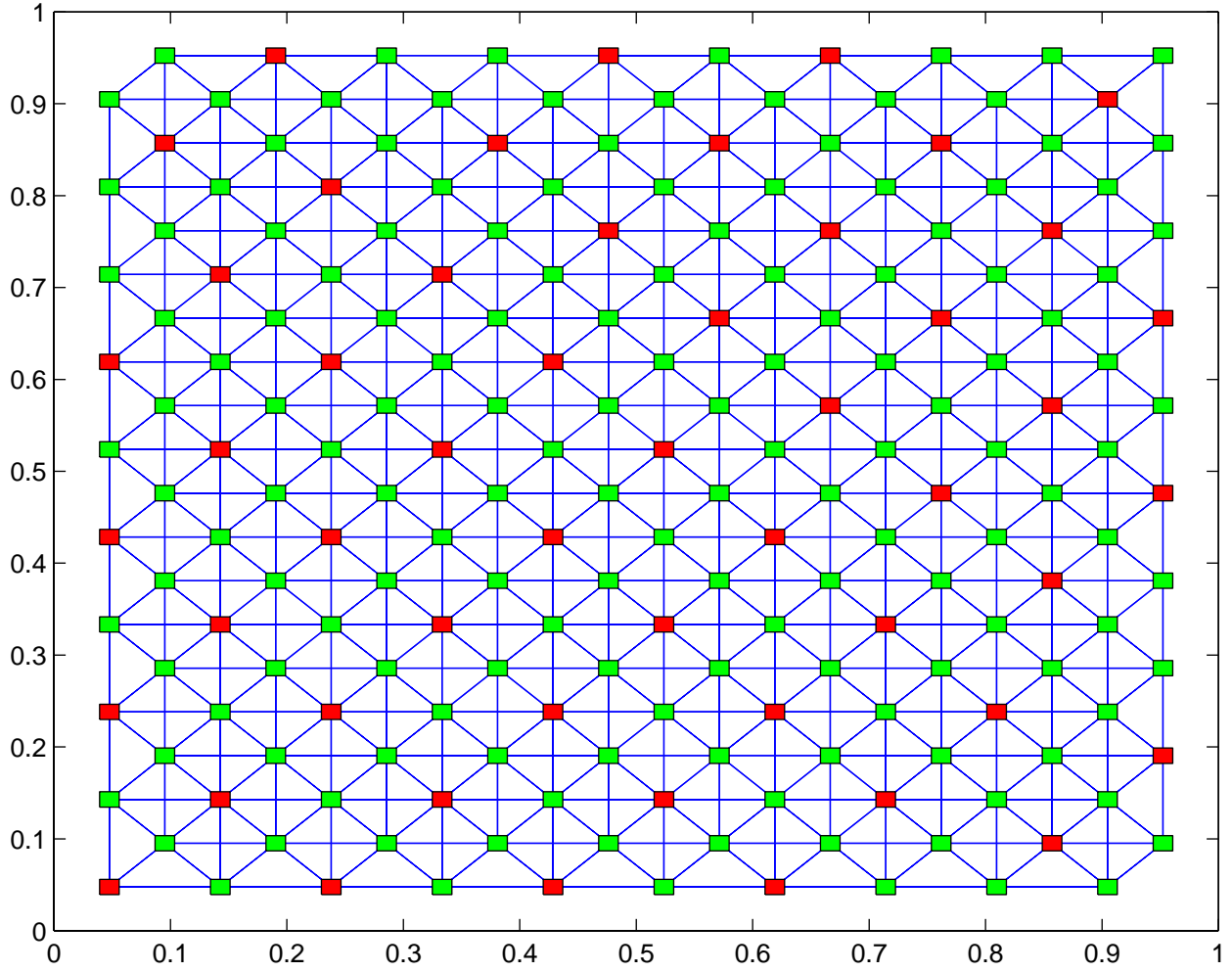


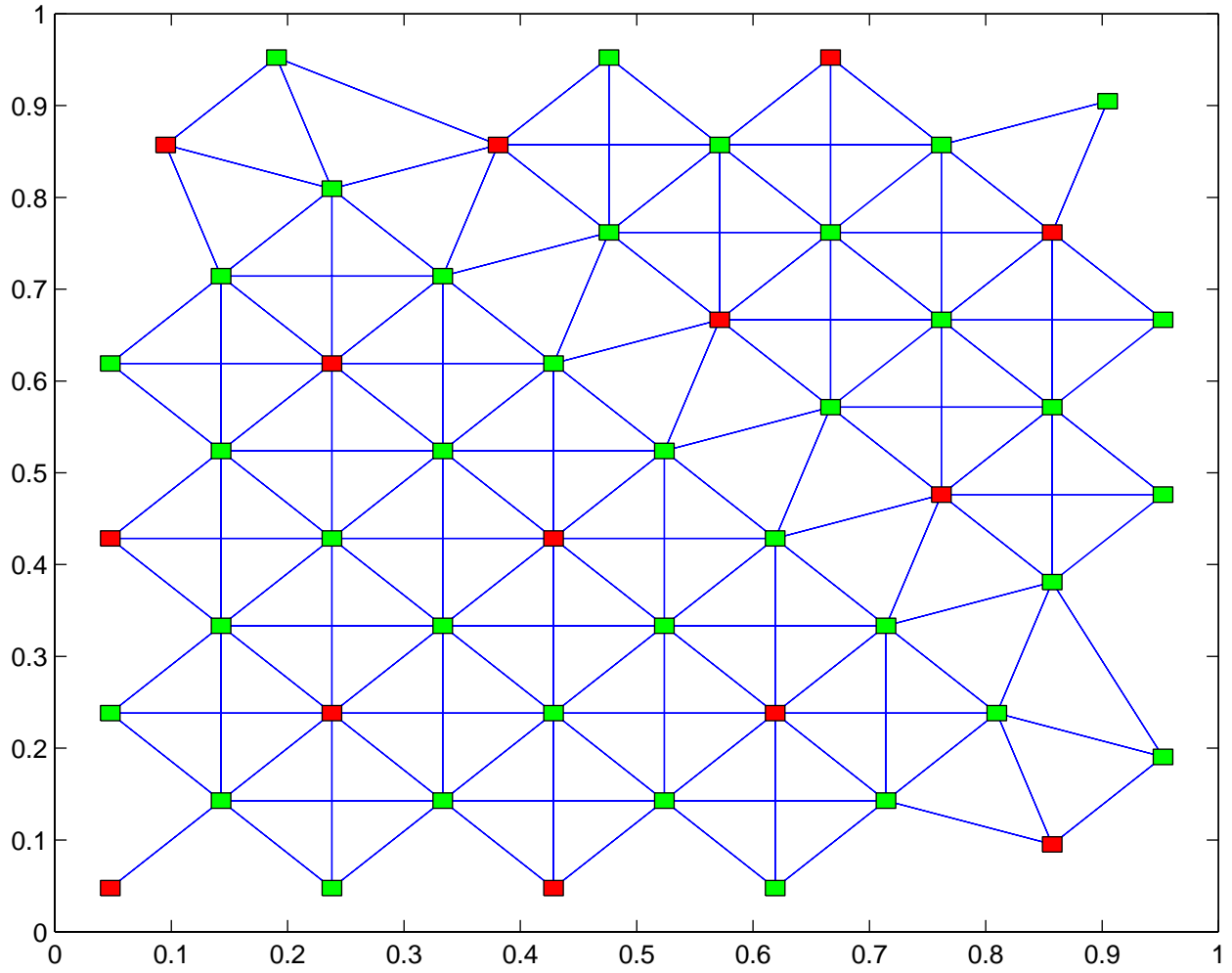
$l = 1$ , nb of coarse points = 200



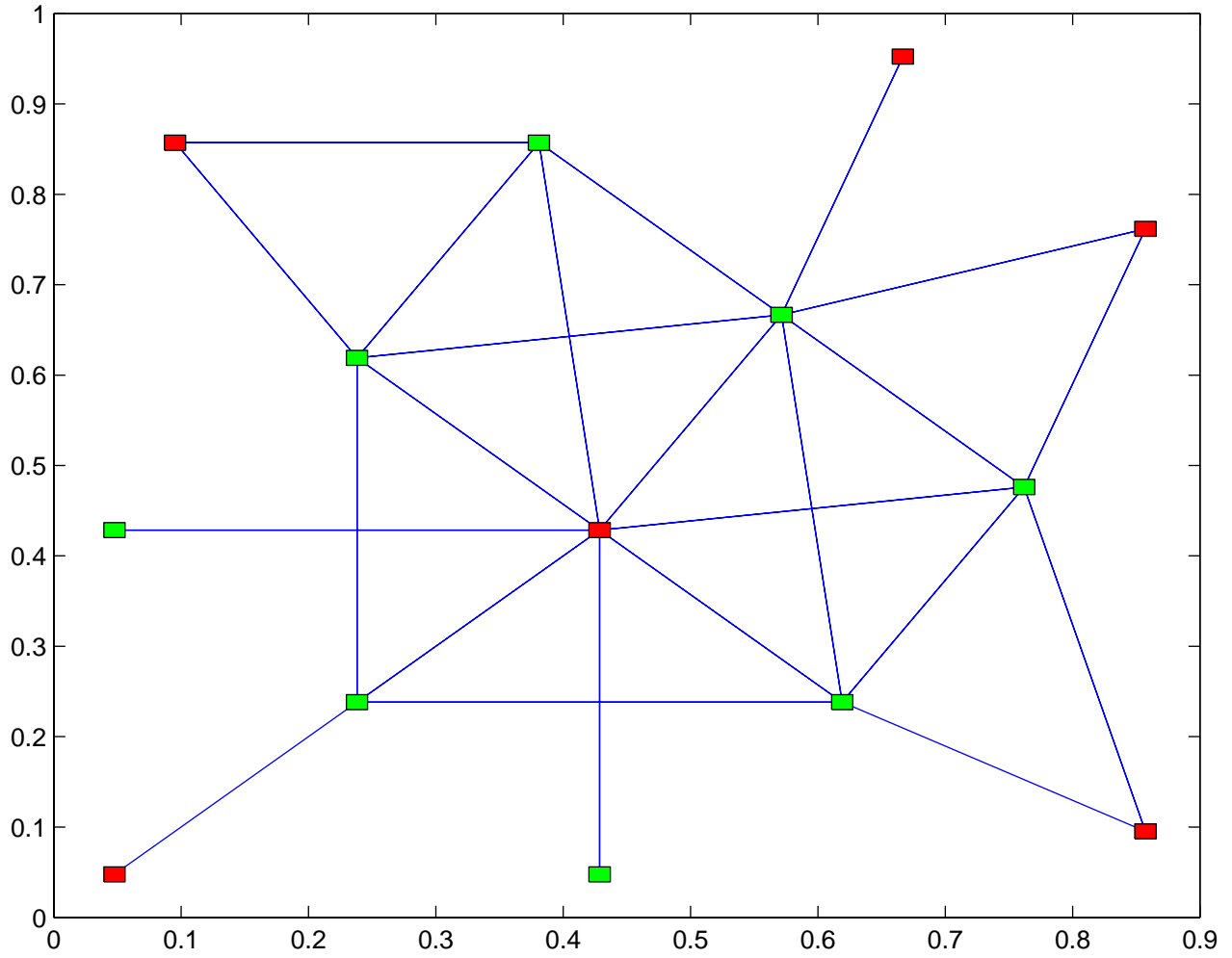
$l = 2$ , nb of coarse points = 51



$l = 3$ , nb of coarse points = 14



$l = 4$ , nb of coarse points = 6



PCG for Poisson equation,  $\tau = 0.06$

multilevel, ('gs', 'a', 'st', 'st'),  $\gamma = 1$

$m$	$\nu = 1$	$\nu = 2$	$\nu = 5$
10	6 op=107129, /n=1071 100-50-14 str=1297, /n=13 $\kappa = 1.05$	5 op=138717, /n=1387 $\kappa = 1.02$	4 op=233153, /n=2332 $\kappa = 1.005$
20	6 op=484856, /n=1212 400-200-51-14 str=5561, /n=13.9 $\kappa = 1.07$	5 op=636731, /n=1592 $\kappa = 1.03$	4 op=1084798, /n=2712 $\kappa = 1.01$
30	6 op=1138521, /n=1265 900-450-119-32-13 str=12995, /n=14.4 $\kappa = 1.06$	5 op=1499701, /n=1666 $\kappa = 1.03$	4 op=2562353, /n=2847 $\kappa = 1.01$
40	7 op=2330221, /n=1456 1600-800-206-53-15 str=23173, /n=14.5 $\kappa = 1.07$	5 op=2681901, /n=1676 $\kappa = 1.03$	5 op=5505957, /n=3441 $\kappa = 1.01$
50	6 op=3222342, /n=1289 2500-1250-324-84-26-17 str=36744, /n=14.7 $\kappa = 1.06$	5 op=4248607, /n=1699 $\kappa = 1.03$	5 op=8727417, /n=3491 $\kappa = 1.01$
60	7 op=5319529, /n=1477 3600-1800-461-119-34-18-13 str=52943, /n=14.7 $\kappa = 1.07$	5 op=6126171, /n=1702 $\kappa = 1.03$	5 op=12584007, /n=3496 $\kappa = 1.01$

PCG for Poisson equation,  $\tau = 0.06$   
 multilevel, ('ic', 'a', 'st', 'st'),  $\gamma = 1$

$m$	$\nu = 1$	$\nu = 2$	$\nu = 5$
10	5 op=85197, /n=852 100-50-14 str=2005, /n=20 $\kappa = 1.02$	4 op=114429, /n=1144  $\kappa = 1.007$	3 op=196072, /n=1961  $\kappa = 1.002$
20	5 op=381911, /n=954.8 400-200-51-14 str=8584, /n=21.5 $\kappa = 1.03$	4 op=521019, /n=1302  $\kappa = 1.01$	4 op=1132936, /n=2832  $\kappa = 1.003$
30	5 op=894202, /n=993.6 900-450-119-32-13 str=20009, /n=22.2 $\kappa = 1.02$	4 op=1223778, /n=1360  $\kappa = 1.01$	4 op=2667643, /n=2964  $\kappa = 1.003$
40	5 op=1598145, /n=998.8 1600-800-206-53-15 str=35667, /n=22.3 $\kappa = 1.03$	5 op=2631408, /n=1644  $\kappa = 1.01$	4 op=4771293, /n=2982  $\kappa = 1.004$
50	5 op=2528438, /n=1011 2500-1250-324-84-26-17 str=56497, /n=22.6 $\kappa = 1.02$	5 op=4165773, /n=1666  $\kappa = 1.01$	4 op=7557527, /n=3023  $\kappa = 1.004$
60	6 op=4265230, /n=1185 3600-1800-461-119-34-18-13 str=81388, /n=22.6 $\kappa = 1.03$	5 op=6008813, /n=1669  $\kappa = 1.01$	4 op=10901958, /n=3028  $\kappa = 1.005$

PCG for Poisson equation,  $\tau = 0.06$   
 multilevel, ('ai', 'a', 'st', 'st'),  $\gamma = 1$

$m$	$\nu = 1$	$\nu = 2$	$\nu = 5$
10	11 op=167073, /n=1670 100-50-14 str=1892, /n=18.9 $\kappa = 1.74$	7 op=171069, /n=1711  $\kappa = 1.22$	4 op=219258, /n=2193  $\kappa = 1.02$
20	13 op=834163, /n=2085 400-200-51-14 str=8179, /n=20.4 $\kappa = 1.96$	9 op=946283, /n=2366  $\kappa = 1.32$	5 op=1199387, /n=2998  $\kappa = 1.03$
30	14 op=2077423, /n=2308 900-450-119-32-13 str=19044, /n=21.2 $\kappa = 2.01$	9 op=2214933, /n=2461  $\kappa = 1.34$	6 op=3299799, /n=3666  $\kappa = 1.04$
40	14 op=3723423, /n=2327 1600-800-206-53-15 str=34278, /n=21.4 $\kappa = 2.03$	10 op=4381433, /n=2738  $\kappa = 1.35$	6 op=5944087, /n=3715  $\kappa = 1.04$
50	14 op=5897948, /n=2359 2500-1250-324-84-26-17 str=54255, /n=21.7 $\kappa = 2.04$	10 op=6949048, /n=2780  $\kappa = 1.35$	6 op=9437844, /n=3775  $\kappa = 1.04$
60	14 op=8515738, /n=2365 3600-1800-461-119-34-18 str=78369, /n=21.8 $\kappa = 2.05$	10 op=10041954, /n=2789  $\kappa = 1.36$	6 op=13648658, /n=3791  $\kappa = 1.04$

PCG for the Poisson equation,  $\tau = 0.06$

multilevel, ('tw', 'a', 'st', 'st')

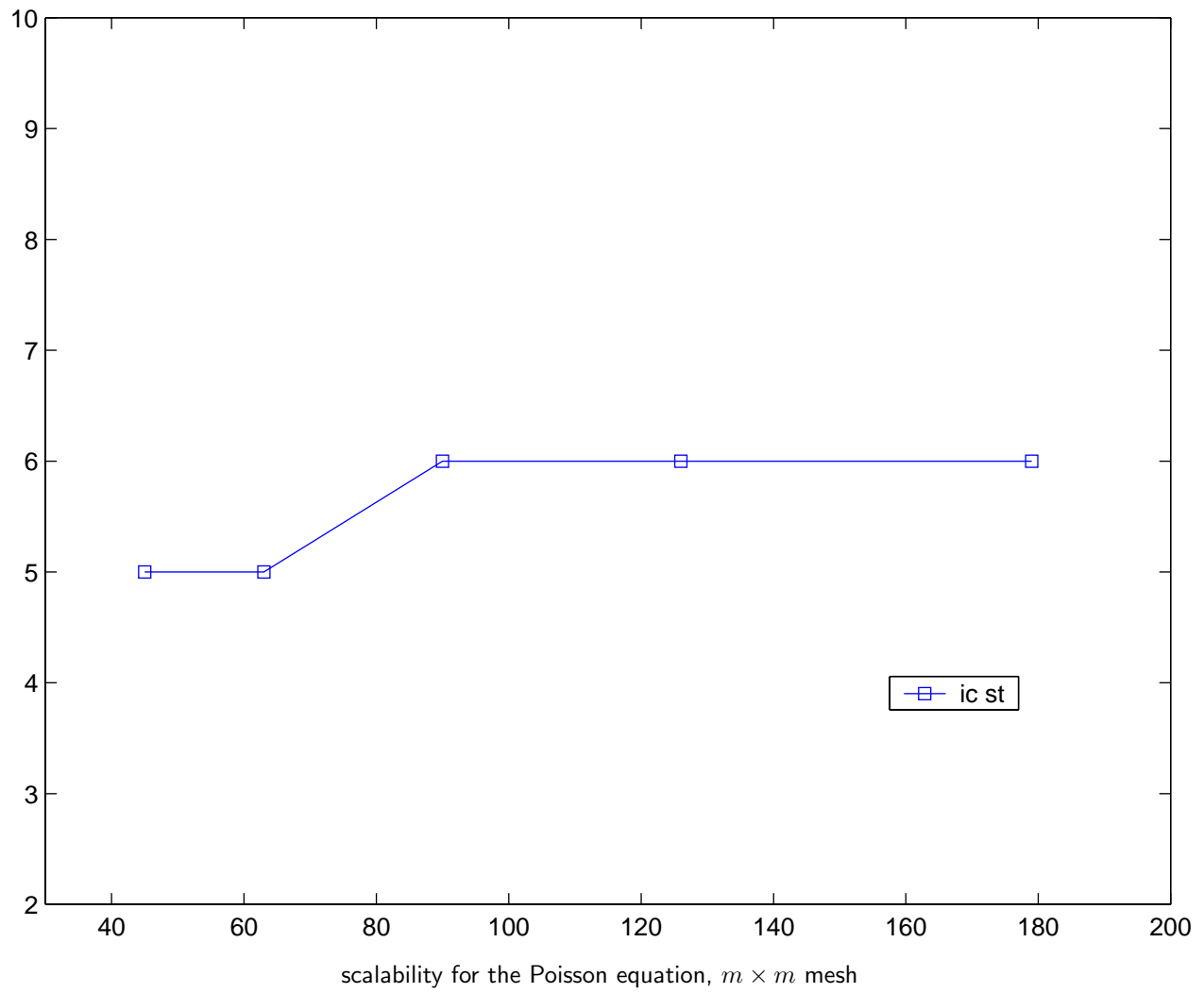
$m$	$\gamma = 1$	$\gamma = 2$
10	7 op=102165, /n=1022 100-50-14 str=2221, /n=22.1	4 op=164873, /n=1649
20	8 op=517790, /n=1294 400-200-51-14 str=9612, /n=24	5 op=1050341, /n=2626
30	7 op=1077525, /n=1197 900-450-119-32-13 str=22481, /n=25	5 op=2707453, /n=3008
40	8 op=2172141, /n=1358 1600-800-206-53-15 str=40139, /n=25.1	5 op=4822437, /n=3014
50	8 op=3438494, /n=1375 2500-1250-324-84-26-17 str=63647, /n=25.5	5 op=8079677, /n=3232
60	8 op=4961032, /n=1378 3600-1800-461-119-34-18 str=91737, /n=25.5	5 op=11601541, /n=3223

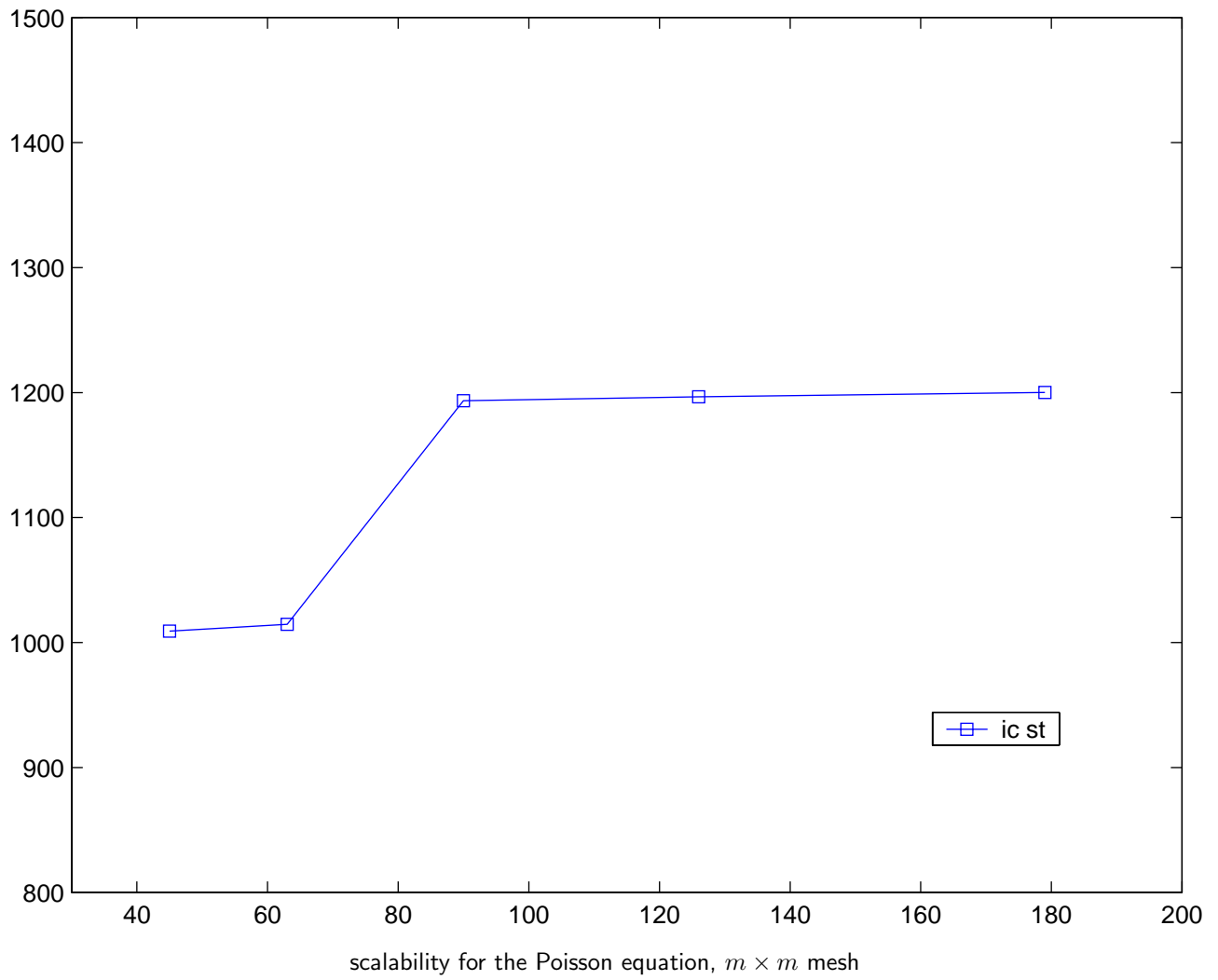


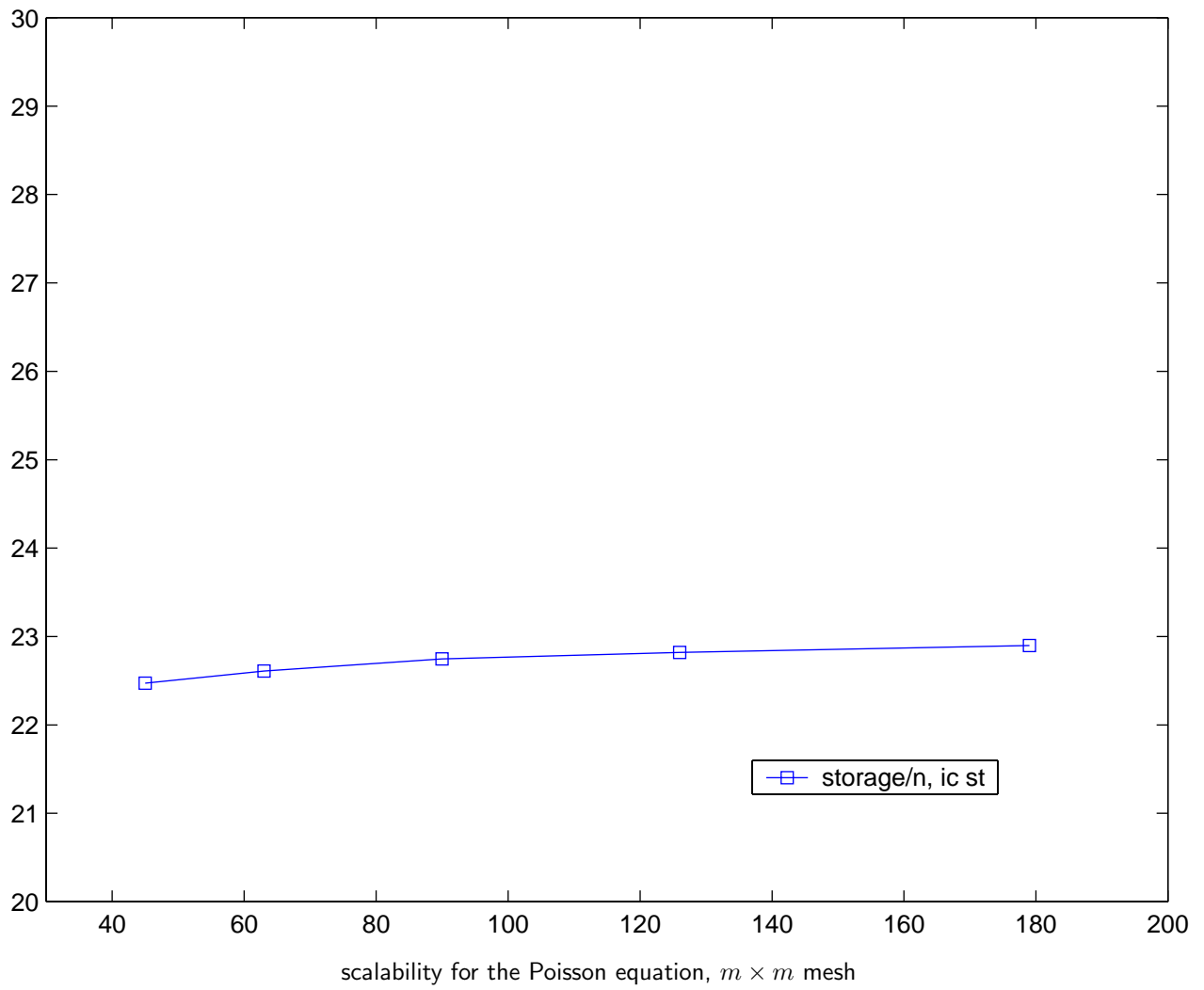
PCG for the Poisson equation,  $\tau = 0.06$

multilevel, ('po', 'a', 'st', 'st'),  $k = 1$

$m$	$\gamma = 1$	$\gamma = 2$
10	6 op=132273, /n=1323 100-50-14 str=1297, /n=13	3 op=200421, /n=2004
20	7 op=681509, /n=1704 400-200-51-14 str=5561, /n=13.9	3 op=1063645, /n=2659
30	7 op=1596741, /n=1774 900-450-119-32-13 str=12995, /n=14.4	3 op=2742053, /n=3047
40	7 op=2852573, /n=1783 1600-800-206-53-15 str=23173, /n=14.5	3 op=4874205, /n=3046
50	7 op=4513885, /n=1806 2500-1250-324-84-26-17 str=36744, /n=14.7	3 op=8163269, /n=3265
60	7 op=6509253, /n=1808 3600-1800-461-119-34-18 str=52943, /n=14.7	3 op=11712861, /n=3254







PCG for the discontinuous problem,  $\tau = 0.06$

multilevel, ('gs', 'a', 'st', 'st')

$m$	$\gamma = 1$	$\gamma = 2$
10	6 op=127378, /n=1274 100-50-16-11 str=1485, /n=14.8 $\kappa = 1.1$	4 op=302737, /n=3027  $\kappa = 1.002$
20	7 op=556267, /n=1391 400-200-46-17-10 str=5448, /n=13.6 $\kappa = 1.3$	4 op=1185685, /n=2964  $\kappa = 1.004$
30	8 op=1507599, /n=1675 900-450-122-30-21 str=13311, /n=14.8 $\kappa = 1.26$	4 op=2938191, /n=3265  $\kappa = 1.002$
39	7 op=2344515, /n=1541 1521-762-204-57-31-21-16 str=23115, /n=15.2 $\kappa = 1.21$	4 op=6702483, /n=4407  $\kappa = 1.002$
50	8 op=4197072, /n=1679 2500-1250-324-88-29-21 str=36892, /n=14.8 $\kappa = 1.35$	4 op=8669991, /n=3468  $\kappa = 1.005$
59	8 op=5931550, /n=1704 3481-1741-446-122-41-22-17 str=52033, /n=14.9 $\kappa = 1.35$	4 op=13191036, /n=3789  $\kappa = 1.004$

PCG for the discontinuous problem,  $\tau = 0.06$   
 multilevel, ('ic', 'a', 'st', 'st')

$m$	$\gamma = 1$	$\gamma = 2$
10	6 op=114269, /n=1143 100-50-16-11 str=2306, /n=23.1 $\kappa = 1.03$	3 op=211467, /n=2115  $\kappa = 1.001$
20	7 op=510529, /n=1276 400-200-46-17-10 str=8491, /n=21.2 $\kappa = 1.2$	4 op=1061224, /n=2653  $\kappa = 1.003$
30	6 op=1062618, /n=1181 900-450-122-30-21 str=20515, /n=22.8 $\kappa = 1.15$	4 op=2599886, /n=2889  $\kappa = 1.001$
39	7 op=2126318, /n=1398 1521-762-204-57-31-21-16 str=35638, /n=23.4 $\kappa = 1.15$	4 op=5851962, /n=3847  $\kappa = 1.002$
50	7 op=3401485, /n=1361 2500-1250-324-88-29-21 str=56811, /n=22.7 $\kappa = 1.27$	4 op=7689215, /n=3076  $\kappa = 1.004$
59	7 op=4799520, /n=1379 3481-1741-446-122-41-22-17 str=80096, /n=23 $\kappa = 1.25$	4 op=11619184, /n=3338  $\kappa = 1.004$

PCG for the discontinuous problem,  $\tau = 0.06$   
 multilevel, ('ai', 'a', 'st', 'st')

$m$	$\gamma = 1$	$\gamma = 2$
10	6 op=151474, /n=1515 100-50-16-11 str=3022, /n=30.2 $\kappa = 1.05$	4 op=319553, /n=3196  $\kappa = 1.002$
20	8 op=940565, /n=2351 400-200-46-17-10 str=13872, /n=34.7 $\kappa = 1.18$	5 op=1930373, /n=4826  $\kappa = 1.02$
30	7 op=2025525, /n=2251 900-450-122-30-21 str=33851, /n=37.6 $\kappa = 1.12$	4 op=4069393, /n=4521  $\kappa = 1.004$
39	7 op=3619203, /n=2379 1521-762-204-57-31-21-16 str=60219, /n=39.6 $\kappa = 1.13$	4 op=8407017, /n=5527  $\kappa = 1.004$
50	7 op=6042413, /n=2417 2500-1250-324-88-29-21 str=100118, /n=40 $\kappa = 1.26$	4 op=12772833, /n=5109  $\kappa = 1.006$
59	7 op=8611390, /n=2474 3481-1741-446-122-41-22-17 str=142531, /n=41 $\kappa = 1.23$	5 op=22832594, /n=6559  $\kappa = 1.005$

PCG for the discontinuous problem,  $\tau = 0.06$

multilevel, ('tw', 'a', 'st', 'st')

$m$	$\gamma = 1$	$\gamma = 2$
10	7 op=117645, /n=1176 100-50-16-11 str=2593, /n=26	4 op=238513, /n=2385
20	9 op=573673, /n=1434 400-200-46-17-10 str=9515, /n=23.8	5 op=1140677, /n=2852
30	9 op=1374733, /n=1527 900-450-122-30-21 str=23150, /n=25.7	5 op=2820349, /n=3134
39	9 op=2405087, /n=1581 1521-762-204-57-31-21-16 str=40325, /n=26.5	5 op=6371455, /n=4189
50	10 op=4232840, /n=1693 2500-1250-324-88-29-21 str=64094, /n=25.6	5 op=8341373, /n=3336
59	9 op=5427707, /n=1559 3481-1741-446-122-41-22-17 str=90549, /n=26	5 op=12632543, /n=3629



PCG for the discontinuous problem,  $\tau = 0.06$

multilevel, ('po', 'a', 'st', 'st')  $k = 1$

$m$	$\gamma = 1$	$\gamma = 2$
10	7 op=176045, /n=1760 100-50-16-11 str=1485, /n=14.8	4 op=364913, /n=3649
20	8 op=769349, /n=1923 400-200-46-17-10 str=5448, /n=13.6	4 op=1460913, /n=3652
30	8 op=1829485, /n=2033 900-450-122-30-21 str=13311, /n=14.8	4 op=3558513, /n=3954
39	8 op=3201265, /n=2105 1521-762-204-57-31-21-16 str=23115, /n=15.2	4 op=8053817, /n=5295
50	9 op=5683443, /n=2273 2500-1250-324-88-29-21 str=36892, /n=14.8	4 op=10528673, /n=4211
59	9 op=8020647, /n=2304 3481-1741-446-122-41-22-17 str=52033, /n=14.9	4 op=15955017, /n=4583

1138-bus  $\tau = 0.06$

<i>method</i>	
('gs', 'a', 'st', 'st')	51 it op=9102650 1138-472-177-70-43 st=12881
('ic', 'a', 'st', 'st')	47 it op=7507981 1138-472-177-70-43 st=20626
('ch', 'a', 'st', 'st')	29 it op=5191420 1138-472-177-70-43 st=20793
('ch', 'a', 'st', 'st') $\epsilon = 0.01$	17 it op=3580910 1138-472-177-70-43 st=24737
('ai', 'a', 'st', 'st')	70 it op=16219507 1138-472-177-70-43 st=30346
('sa', 'a', 'st', 'st')	33 it op=8325960 1138-472-177-70-43 st=30911
('tw', 'a', 'st', 'st')	277 it op=38431313 1138-472-177-70-43 st=22671
('po', 'a', 'st', 'st')	144 it op=30308391 1138-472-177-70-43 st=12881

## 1138-bus

<i>method</i>	
IC(0)	162 it op=9790090 st=3734
sa(0.06)	81 it op=7868910 st=10019
IC(0.01)	44 it op=3337020 st=6242

Nos 7  $\tau = 0.1$

<i>method</i>	
('gs', 'a', 'st', 'st')	14 it op=4900287 729-363-263-180-145 st=28130
('ic', 'a', 'st', 'st')	10 it op=3068369 729-363-263-180-145 st=42047
('ch', 'a', 'st', 'st')	11 it op=2720527 729-363-263-180-145 st=34264
('ch', 'a', 'st', 'st') $\epsilon = 0.01$	9 it op=2599113 729-363-263-180-145 st=38824
('ai', 'a', 'st', 'st')	25 it op=6165459 729-363-263-180-145 st=36351
('sa', 'a', 'st', 'st')	21 it op=5191731 729-363-263-180-145 st=36221
('tw', 'a', 'st', 'st')	15 it op=4224915 729-363-263-180-145 st=50924
('po', 'a', 'st', 'st')	26 it op=10057891 729-363-263-180-145 st=28130

## Nos 7

<i>method</i>	
IC(0)	42 it op=2237350 st=3402
sa(0.1)	57 it op=3076240 st=3662
IC(0.01)	16 it op=946863 st=4254