

Comparison on Number of Floating-Point Operations

Among Different Ordering Methods

Different ordering methods are compared. 111 matrices (dimension > 1000) from circuit simulation and power network problems are used. As shown in the following table, the selected best ordering method by CKTSO generally produces the fewest floating-point operations. On *geometric mean*, CKTSO selected best produces **32%** fewer operations than approximate minimum degree, and **49%** fewer operations than METIS.

Matrix	Approximate minimum degree	CKTSO best of minimum degree variants	CKTSO nested dissection	CKTSO best of all	METIS
1138_bus	1.438E+04	1.411E+04	1.424E+04	1.411E+04	1.962E+04
activsg10k	4.614E+06	4.116E+06	4.802E+06	4.116E+06	6.000E+06
activsg2000	2.034E+06	1.800E+06	1.836E+06	1.800E+06	2.734E+06
activsg70k	8.870E+06	7.700E+06	1.180E+07	7.700E+06	1.314E+07
add20	1.332E+05	1.332E+05	1.361E+05	1.332E+05	1.857E+05
add32	5.365E+04	5.358E+04	5.375E+04	5.358E+04	6.332E+04
adder_dcop_01	5.053E+04	5.053E+04	5.049E+04	5.053E+04	5.265E+04
adder_trans_01	1.737E+05	1.737E+05	1.760E+05	1.737E+05	2.010E+05
asic_100k	1.113E+09	6.453E+08	5.811E+08	5.811E+08	6.097E+08
asic_100ks	1.394E+09	5.755E+08	6.452E+08	5.755E+08	6.323E+08
asic_320k	1.228E+09	6.264E+08	1.285E+11	6.264E+08	1.236E+11
asic_320ks	1.369E+09	6.177E+08	7.751E+08	6.177E+08	7.541E+08
asic_680k	9.994E+08	6.044E+08	2.629E+11	6.044E+08	8.101E+11
asic_680ks	9.183E+08	5.906E+08	6.633E+08	5.906E+08	6.930E+08
bcircuit	1.131E+07	9.750E+06	1.272E+07	9.750E+06	1.646E+07
bips07_1693	3.250E+05	3.163E+05	4.417E+05	3.163E+05	6.055E+05
bips07_1998	4.369E+05	4.293E+05	5.187E+05	4.293E+05	7.135E+05
bips98_1142	3.024E+05	3.002E+05	4.420E+05	3.002E+05	5.117E+05
bips98_1450	3.124E+05	3.104E+05	3.868E+05	3.104E+05	5.185E+05
bips98_606	2.905E+05	2.905E+05	3.569E+05	2.905E+05	4.543E+05
case9	4.680E+06	3.782E+06	4.846E+06	3.782E+06	5.581E+06
circuit204	1.590E+05	1.326E+05	1.278E+05	1.326E+05	2.175E+05
circuit5m	1.104E+09	8.956E+08	9.331E+09	8.956E+08	4.520E+10
circuit5m_dc	2.708E+10	8.886E+09	4.696E+09	4.696E+09	4.401E+09
circuit_1	9.111E+05	9.111E+05	9.844E+05	9.111E+05	1.058E+06
circuit_2	4.172E+05	4.172E+05	7.438E+05	4.172E+05	9.565E+05
circuit_3	2.558E+05	2.491E+05	2.698E+05	2.491E+05	3.031E+05
circuit_4	5.458E+06	4.953E+06	1.050E+07	4.953E+06	1.037E+07
ckt11752_dc_1	3.578E+07	2.376E+07	3.696E+07	2.376E+07	4.239E+07
ckt11752_tr_0	3.578E+07	2.376E+07	3.696E+07	2.376E+07	4.239E+07
coupled	2.473E+07	1.923E+07	2.750E+07	1.923E+07	2.655E+07
dc1	3.603E+07	2.441E+07	2.123E+08	2.441E+07	4.789E+08
dc2	3.603E+07	2.441E+07	2.123E+08	2.441E+07	4.789E+08
dc3	3.603E+07	2.441E+07	2.451E+08	2.441E+07	6.556E+08

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dinesh	4.685E+08	4.056E+08	2.443E+08	2.443E+08	2.848E+08
fpga_dcop_01	2.094E+04	2.094E+04	2.112E+04	2.094E+04	2.131E+04
fpga_trans_01	3.460E+04	3.460E+04	3.467E+04	3.460E+04	3.740E+04
freescall1	1.248E+10	7.879E+09	4.267E+09	4.267E+09	5.358E+09
freescall2	2.762E+09	2.429E+09	2.930E+09	2.429E+09	3.338E+09
fullchip	1.793E+12	3.074E+11	1.275E+11	1.275E+11	1.817E+11
g2_circuit	1.003E+10	5.057E+09	2.985E+09	2.985E+09	3.109E+09
g3_circuit	5.993E+11	2.344E+11	9.119E+10	9.119E+10	8.923E+10
gemat11	3.474E+05	3.474E+05	3.527E+05	3.474E+05	4.759E+05
gemat12	3.500E+05	3.500E+05	3.646E+05	3.500E+05	5.485E+05
hamrle2	4.164E+05	3.988E+05	7.578E+05	3.988E+05	9.922E+05
hamrle3	2.922E+11	1.277E+11	1.708E+11	1.277E+11	1.768E+11
hans	1.987E+09	1.444E+09	1.407E+09	1.407E+09	1.525E+09
hcircuit	2.522E+06	2.492E+06	2.514E+06	2.492E+06	3.108E+06
htc_336_4438	2.281E+08	1.720E+08	1.913E+08	1.720E+08	1.892E+08
htc_336_9129	2.048E+08	1.745E+08	1.946E+08	1.745E+08	1.932E+08
hvdcl	1.366E+06	1.367E+06	1.544E+06	1.367E+06	2.055E+06
hvdcl2	4.155E+07	3.796E+07	4.190E+07	3.796E+07	5.363E+07
legresley_2508	1.905E+05	1.905E+05	2.061E+05	1.905E+05	2.758E+05
legresley_4908	1.704E+05	1.704E+05	1.803E+05	1.704E+05	2.705E+05
legresley_87936	2.001E+07	1.730E+07	2.176E+07	1.730E+07	2.485E+07
leo	3.025E+08	3.025E+08	4.158E+08	3.025E+08	2.240E+08
meg1	5.394E+06	5.225E+06	5.342E+06	5.225E+06	5.229E+06
memchip	3.641E+11	1.934E+11	1.415E+10	1.415E+10	1.475E+10
memplus	1.453E+06	1.453E+06	2.883E+06	1.453E+06	2.899E+06
mimo28x28_system	2.994E+05	2.992E+05	3.754E+05	2.992E+05	5.226E+05
mimo46x46_system	2.994E+05	2.992E+05	4.057E+05	2.992E+05	4.892E+05
mimo8x8_system	2.998E+05	2.990E+05	4.065E+05	2.990E+05	5.411E+05
mult_dcop_01	3.420E+06	2.747E+06	4.002E+06	4.002E+06	6.430E+06
mult_dcop_02	3.420E+06	2.747E+06	4.002E+06	4.002E+06	6.430E+06
mult_dcop_03	2.871E+06	2.745E+06	5.787E+06	5.787E+06	5.276E+06
nopss_11k	3.048E+05	2.958E+05	3.613E+05	2.958E+05	5.211E+05
npx1	1.001E+10	5.747E+09	3.628E+09	3.628E+09	3.563E+09
onetone1	1.126E+09	1.123E+09	7.773E+08	7.773E+08	9.560E+08
onetone2	2.324E+08	1.052E+08	1.574E+08	1.052E+08	1.613E+08
opf_10000	6.234E+06	6.234E+06	6.290E+06	6.234E+06	9.643E+06
opf_3754	1.855E+06	1.855E+06	1.951E+06	1.855E+06	2.797E+06
power197k	1.539E+09	1.346E+09	1.440E+09	1.346E+09	1.640E+09
powersim	2.633E+05	2.664E+05	2.949E+05	2.664E+05	4.355E+05
pre2	4.225E+11	2.162E+11	1.059E+11	1.059E+11	1.143E+11
qh1484	4.274E+04	4.274E+04	4.183E+04	4.274E+04	5.789E+04
raj1	7.182E+08	5.159E+08	4.175E+08	4.175E+08	4.029E+08
rajat03	6.981E+06	4.711E+06	4.042E+06	4.711E+06	4.470E+06
rajat12	5.496E+04	5.496E+04	5.500E+04	5.496E+04	5.999E+04
rajat13	2.103E+05	2.103E+05	2.182E+05	2.103E+05	1.998E+05

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rajat15	1.318E+08	9.092E+07	7.138E+07	7.138E+07	8.926E+07
rajat16	8.930E+08	3.886E+08	3.407E+08	3.407E+08	3.916E+08
rajat17	8.930E+08	3.886E+08	3.598E+08	3.598E+08	3.650E+08
rajat20	6.002E+08	3.241E+08	5.360E+08	3.241E+08	2.896E+08
rajat21	7.843E+06	7.061E+06	1.408E+07	7.061E+06	1.989E+07
rajat22	1.006E+06	1.008E+06	1.029E+06	1.008E+06	1.154E+06
rajat23	3.755E+06	3.755E+06	4.092E+06	3.755E+06	4.711E+06
rajat24	5.763E+08	3.407E+08	3.626E+09	3.407E+08	2.576E+09
rajat25	5.644E+08	3.249E+08	2.736E+08	2.736E+08	2.669E+08
rajat26	1.518E+06	1.518E+06	1.600E+06	1.518E+06	1.954E+06
rajat27	9.273E+05	9.273E+05	8.956E+05	9.273E+05	1.123E+06
rajat28	5.951E+08	3.467E+08	2.774E+08	2.774E+08	3.420E+08
rajat29	2.895E+08	2.225E+08	3.102E+10	2.225E+08	3.690E+10
rajat30	4.723E+09	2.679E+09	9.187E+10	2.679E+09	3.812E+11
rajat31	4.272E+11	1.129E+11	1.009E+11	1.009E+11	1.068E+11
scircuit	4.915E+07	4.153E+07	5.329E+07	4.153E+07	5.988E+07
steffen	4.647E+10	2.197E+10	1.397E+10	1.397E+10	1.281E+10
steve_mem	6.926E+11	8.537E+10	2.633E+10	2.633E+10	2.295E+10
sushil	3.683E+09	2.065E+09	1.748E+09	1.748E+09	1.708E+09
totyo_bsimcmg	2.289E+09	1.593E+09	1.224E+09	1.224E+09	1.350E+09
trans4	3.603E+07	2.441E+07	2.123E+08	2.441E+07	4.789E+08
trans5	3.603E+07	2.441E+07	2.123E+08	2.441E+07	4.789E+08
transient	2.271E+08	1.598E+08	4.718E+08	1.598E+08	3.711E+08
tsopf_fs_b39_c19	2.581E+08	1.690E+08	2.795E+08	1.690E+08	2.885E+08
tsopf_fs_b39_c30	4.070E+08	2.458E+08	4.300E+08	2.458E+08	4.559E+08
tsopf_fs_b9_c1	1.266E+06	9.399E+05	8.569E+05	9.399E+05	9.618E+05
tsopf_fs_b9_c6	4.680E+06	3.782E+06	4.846E+06	3.782E+06	5.581E+06
tsopf_rs_b9_c6	1.798E+05	1.798E+05	4.005E+05	1.798E+05	9.839E+05
twotone	7.167E+09	5.367E+09	1.033E+10	5.367E+09	1.213E+10
ww_vref_6405	2.994E+05	2.992E+05	3.754E+05	2.992E+05	5.226E+05
xingo_afonso_itaipu	2.994E+05	2.992E+05	3.791E+05	2.992E+05	5.286E+05
zeros_nopss_13k	2.982E+05	2.975E+05	3.932E+05	2.975E+05	5.180E+05