	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
3pk	21	0	1.72	21	0.01	1.72
aircrfta	7	0	0	7	0	0
aircrftb	10	0	6.23E-014	10	0	6.23E-014
airport	19	0.04	47952.7	19	0.1	47952.7
aljazzaf	40	0	75	25	0	75
allinit	12	0	16.71	12	0	16.71
allinitc			(IL)	221	0.01	3.05E+001*
allinitu	9	0	5.74	9	0	5.74
alsotame	10	0	0.08	10	0	0.08
argauss			(IL)			(INF)
arglina	2	0.02	100	2	0.06	100
arglinb	2	0	4.63	2	0	4.63
arglinc	2	0	6.14	2	0	6.14
argtrig	8	0.17	0	8	0.17	0
artif			(IL)	203	12.49	0
arwhead	6	0.31	1.63E-011	6	0.32	1.63E-011
aug2d	2	0.63	1687411.75	2	0.65	1687411.75
aug2dc	2	0.66	1818344.36	2	0.67	1818344.36
aug2dcqp	24	3.62	6497507.24	24	3.83	6.50E+006
aug2dqp	23	3.52	6236116.84	23	3.69	6236116.84
aug3d	7	1.74	554.06	7	1.76	554.06
aug3dc	2	0.17	771.26	2	0.17	771.26
aug3dcqp	14	0.3	993.39	14	0.3	993.39
aug3dqp	14	0.27	675.28	14	0.28	675.28
avion2	141	0.06	94680131.09	78	0.03	94680129.63
bard	8	0	0.01	8	0	8.21E-003
bdexp	13	0.51	0	13	0.5	2.41E-004
bdqrtic	10	0.15	3983.82	10	0.15	3983.82
bdvalue	6	0.38	0	6	0.38	0.00E+000
beale	8	0	1.28E-013	8	0	1.28E-013
bigbank	24	0.21	-4205697.22	24	0.22	-4205697.22
biggs3	9	0	7.24E-021	9	0	7.24E-021
biggs5	25	0	1.99E-014	25	0.01	1.99E-014
biggs6	36	0	1.84E-012	36	0.01	1.84E-012
biggsb1	22	0.05	0.02	22	0.12	0.02
biggsc4	31	0	-24.5	31	0	-24.5
blockqp1	19	0.2	-996.5	19	0.2	-996.5
blockqp2	12	0.14	-995.1	12	0.14	-995.1
blockqp3	32	0.33	-497.5	32	0.33	-497.5
blockqp4	18	0.2	-498.1	18	0.2	-498.1
blockqp5	35	0.35	-497.5	35	0.35	-497.5
bloweya	13	0.17	-0.05	13	0.17	-0.05
bloweyb	13	0.17	-0.03	13	0.17	-0.03
bloweyc	16	0.2	-0.03	16	0.2	-0.03
booth	2	0	0	2	0	0
box2	9	0	8.68E-020	9	0	8.68E-020
box3	8	0	4.09E-011	8	0	4.09E-011
bqp1var	10	0	6.27E-009	10	0	6.27E-009
bqpgabim	17	0.01	-3.79E-005	17	0.01	-3.79E-005
bqpgasim	17	0.01	-5.52E-005	17	0.01	-5.52E-005
bqpgauss	42	1.86	-0.36	42	1.07	-3.63E-001
brainpc0			(IL)	2377	505.86	0.34
brainpc1	309	72.34	0	92	19.17	0
brainpc2	414	205.33	0	242	118.74	4.42E-004
brainpc3	134	22.21	0	243	42.93	0
brainpc4			(IL)			(IMP)
brainpc5			(IL)	66	12.81	0
brainpc6			(IL)	346	71.15	3.77E-004*
brainpc7	187	31.16	0	147	28.84	0

TABLE 1. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
brainpc8	303	62.42	0	93	17.52	0
brainpc9			(IL)	352	67.23	3.56E-004*
bratu1d	6	0.06	-8.52	6	0.06	-8.52
bratu2d	6	0.75	0	6	0.76	0
bratu2dt	8	1.01	0	8	1.03	0
bratu3d	6	3.95	0	6	4.04	0
bridgend	335	11.36	36712.56	491	16.12	36712.56
britgas	15	0.12	3.19E-008	15	0.12	3.19E-008
brkmcc	3	0	0.17	3	0	0.17
brownal	6	0	6.33E-008	6	0	6.33E-008
brownbs	14	0	4.39E-019	7	0	2.47E-027
brownden	8	0	85822.2	8	0	85822.2
broydn3d	7	0.54	0	7	0.56	0.00E+000
broydn7d	48	0.56	364.07	48	0.56	3.64E+002
broydnbd	8	0.97	0	8	1.01	0.00E+000
brybnd	7	0.9	4.51E-007	7	0.92	4.51E-007
bt1	140	0.01	-1	23	0	-1
bt10	10	0	-1	10	0	-1
bt11	11	0	0.82	11	0	0.82
bt12	8	0	6.19	8	0	6.19
bt13	44	0	2.90E-026	47	0.01	4.85E-026
bt2	18	0	0.03	18	0	0.03
bt3	2	0	4.09	2	0	4.09
bt4	11	0	-45.51	11	0	-4.55E+001
bt5	9	0	961.72	9	0	961.72
bt6	13	0	0.28	13	0	0.28
bt7	19	0	360.38	19	0	360.38
bt8	14	0	1	14	0	1
bt9	34	0	-1	11	0	-1
byrdsphr	24	0	-4.68	15	0	-4.68
camel6	12	0	-1.03	10	0	-1.03
camshape	145	1.67	4.27	145	1.69	4.27
cantilvr	16	0	1.34	16	0	1.34
catena	228	0.04	-23077.75	32	0.02	-23077.74
catenary			(IL)	36	0.09	-348400.93
catmix	24	0.74	-0.05	24	0.76	-4.81E-002
cb2	15	0	1.95	15	0	1.95E+000
cb3	12	0	2	12	0	2
cbratu2d	6	0.11	0	6	0.11	0
cbratu3d	7	0.4	0	7	0.4	0
chaconn1	10	0	1.95	10	0	1.95E+000
chaconn2	11	0	2	11	0	2
chain	1192	34.54	6.91	1204	35.99	6.91E+000
chainwoo	72	0.56	47.93	72	0.57	4.79E+001
chandheq	15	0.53	0	15	0.53	0
channel	20	0.67	1	20	0.68	1
chebyqad	117	42.01	0.01	180	67.24	0.01
chemrcta			(IL)			(IMP)
chemrctb			(IL)			(IMP)
chenhark	12	0.03	-2	12	0.06	-2
chnrosnb	44	0.01	6.87E-015	44	0.02	6.87E-015
cliff	28	0	0.2	28	0	0.2
clnlbeam	118	1.41	344.88	72	0.97	3.45E+002
clplatea	6	0.42	-0.01	6	0.43	-0.01
clplateb	6	0.44	-6.99	6	0.45	-6.99E+000
clplatec	2	0.14	-0.01	2	0.14	-0.01
cluster	10	0	0	10	0	0
concon	81	0.01	-6230.8	81	0.02	-6230.8
congigmz	28	0	28	28	0	28

TABLE 2. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
cont6-qq	33	47.68	-4.28	33	47.19	-4.28E+000
coolhans	21	0	0	234	0.11	9.99E-010
core1	158	0.07	91.06	157	0.07	91.06
core2			(IL)			(IMP)
corkscrw	36	2.83	90.69	36	2.61	9.07E+001
coshfun	392	0.16	-0.8	56	0.06	-0.77
cosine	11	0.81	-9999	11	0.82	-9999
cragglvy	14	0.74	1688.22	14	0.76	1.69E+003
cresc100			(IL)	293	0.66	0.57
cresc132			(IL)	2069	125.11	0.68
cresc4	66	0.01	0.87	76	0.01	0.87
cresc50			(IL)			(IL)
csfi1	22	0	-49.08	22	0	-49.08
csfi2	109	0.01	55.02	105	0.02	55.02
cube	27	0	4.04E-014	27	0	4.04E-014
curly10	14	2.51	-1003162.9	14	2.52	-1003162.9
curly20	16	5.51	-1003162.9	16	5.5	-1003162.9
curly30	12	7.51	-1003162.9	12	7.52	-1003162.9
cvxbqp1	19	2.85	2250225	19	2.91	2.25E+006
cvxqp1	35	1.16	1087511.57	35	1.16	1.09E+006
dallasl	51	0.3	-202604.13	51	0.32	-202604.13
dallasm	36	0.03	-48198.19	36	0.09	-48198.19
dallass	40	0.01	-32393.23	40	0.03	-32393.23
deconvb	54	0.08	0	64	0.09	0
deconvc	104	0.2	0	317	0.52	2.57E-003*
deconvu	16	0.03	1.99E-006	16	0.07	1.99E-006
degenlpa	29	0	3.06	29	0.01	3.06
degenlpb	31	0	-30.73	31	0.01	-30.73
degenqp	13	0.8	6.80E-009	13	0.8	6.80E-009
dembo7	136	0.06	174.91	143	0.05	174.79
demymalo	19	0	-3	19	0	-3
denschna	7	0	1.10E-023	7	0	1.10E-023
denschnb	28	0	3.13E-019	28	0	3.13E-019
denschnc	10	0	5.34E-011	10	0	5.34E-011
denschnd	30	0	1.69E-010	30	0	1.69E-010
denschne	11	0	4.89E-025	11	0	4.89E-025
denschnf	6	0	2.31E-010	6	0	2.31E-010
dipigri	10	0	680.63	25	0.01	680.63
disc2	42	0.01	1.56	42	0.03	1.56
discs			(IL)	91	0.06	15.29
dittert			(IL)			(IMP)
dixchlng	34	0	2471.9	34	0.01	2471.9
dixchlnv	127	0.78	1.67E-016	437	3.26	4.66E-008*
dixmaana	6	0.12	1	6	0.12	1
dixmaanb	10	0.42	1	10	0.42	1
dixmaanc	9	0.38	1	9	0.38	1.00E+000
dixmaand	10	0.42	1	10	0.42	1
dixmaane	12	0.28	1	12	0.28	1
dixmaanf	15	0.69	1	15	0.69	1
dixmaang	17	0.92	1	17	0.93	1.00E+000
dixmaanh	16	0.74	1	16	0.74	1
dixmaani	16	0.4	1	16	0.41	1
dixmaanj	27	1.38	1	27	1.42	1.00E+000
dixmaank	21	0.96	1	21	0.98	1.00E+000
dixmaanl	21	0.97	1	21	0.98	1.00E+000
dixon3dq	2	0	2.86E-018	2	0	2.86E-018
djtl	9	0	-8852.44	9	0	-8852.44
dnieper	27	0.01	18744.01	27	0.03	18744.01
dqdrtic	2	0.06	5.82E-019	2	0.06	5.82E-019

TABLE 3. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
dqrtic	25	0.37	7.77	25	0.36	7.77
drugdis			(IL)			(IMP)
drugdise			(IL)			(IMP)
dtoc1l	7	1.3	125.34	7	1.34	125.34
dtoc1na	7	0.96	12.7	7	1.01	12.7
dtoc1nb	7	0.97	15.94	7	1.01	1.59E+001
dtoc1nc	10	1.59	24.97	10	1.67	2.50E+001
dtoc1nd	32	2.96	12.79	60	6.06	1.26E+001
dtoc2	14	1.12	0.51	14	1.16	0.51
dtoc3	2	0.2	235.26	2	0.21	235.26
dtoc4	11	1.21	2.87	11	1.27	2.87E+000
dtoc5	10	0.6	1.53	10	0.63	1.53E+000
dtoc6	21	1.59	134846.37	21	1.68	1.35E+005
dual1	22	0.09	0.04	22	0.09	0.04
dual2	20	0.12	0.03	20	0.12	0.03
dual3	27	0.25	0.14	27	0.25	0.14
dual4	23	0.06	0.75	23	0.06	0.75
dualc1	26	0	6155.25	26	0.01	6155.25
dualc2	20	0	3551.31	20	0	3551.31
dualc5	12	0	427.23	12	0	427.23
dualc8	18	0	18309.36	18	0.01	18309.36
edensch	7	0.12	12003.28	7	0.12	12003.28
eg1	8	0	-1.43	8	0	-1.43
eg2	4	0.02	-998.95	4	0.04	-998.95
eg3	22	0.02	3.79E-012	22	0.06	3.79E-012
eigena2	12	0.03	3.53E-011	12	0.09	3.53E-011
eigenaco	17	0.12	1.68E-011	17	0.12	1.68E-011
eigenb2	56	0.27	0.06	56	0.26	0.06
eigenbco	50	0.34	1.09E-010	50	0.34	1.09E-010
eigenc2	44	8.4	9.87E-010	44	8.47	9.87E-010
eigencco	16	0.01	1.89E-011	16	0.02	1.89E-011
eigmaxa	59	0.04	-1	60	0.05	-1
eigmaxb	13	0.02	-0.41	13	0.04	-0.41
eigmaxc			(IL)	93	0.11	-0.25
eigmina	58	0.04	1	51	0.04	1
eigminc	14	0.02	0.25	14	0.05	0.25
elattar	39	0.06	1.12E-009	39	0.06	1.12E-009
elec	113	103.01	18439.09	117	109.69	1.84E+004
engval1	8	0.27	5548.67	8	0.28	5548.67
engval2	17	0	5.45E-014	17	0	5.45E-014
eqc			(IL)	82	0.01	-911.24
errinbar			(IL)			(IMP)
errinros	29	0.01	40.4	29	0.01	40.4
expfit	7	0	0.24	7	0	0.24
expfita	20	0	0	20	0.01	1.14E-003
expfitb	24	0.01	0.01	24	0.02	0.01
expfitc	34	0.05	0.02	34	0.06	0.02
explin	22	0.01	-723756.26	22	0.01	-723756.26
explin2	22	0.01	-724459.14	22	0.01	-724459.14
expquad	26	0.01	-3624599.89	50	0.05	-3.62E+006
extrasim	10	0	1	10	0	1
extrosnb	1	0	0	1	0	0
fccu	2	0	11.15	2	0	11.15
fletcbv2	2	0	-0.51	2	0	-0.51
fletchcr	15	0.01	7.88E-009	15	0.01	7.88E-009
fletcher	15	0	19.53	15	0	19.53
flosp2hh	3	0.13	38.87	3	0.13	38.87
flosp2hl	3	0.12	38.87	3	0.12	38.87
flosp2hm	3	0.16	38.87	3	0.16	38.87

TABLE 4. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
flosp2th	4	0.14	10	4	0.14	10
flosp2tl	2	0.07	10	2	0.08	10
flosp2tm	2	0.07	10	2	0.07	10
fminsrf2			(IL)			(IL)
fminsurf			(IL)			(IL)
freuroth	8	0.63	608159.19	8	0.64	608159.19
gasoil	78	65.78	0.01	95	69.44	0.01
gausselm			(IL)	1778	108.31	-1.80E+001
genhs28	2	0	0.93	2	0	0.93
genhumps	101	0	3.29E-020	101	0.01	3.29E-020
genrose	741	0.94	1	741	0.97	1.00E+000
gigomez1	19	0	-3	16	0	-3
gigomez2	12	0	1.95	12	0	1.95
gigomez3	12	0	2	12	0	2.00E+000
gilbert	25	21.78	482.03	25	24.68	482.03
glider			(IL)			(IL)
gmncase1	14	0.69	0.27	14	0.69	0.27
gmncase2	12	0.55	-0.99	12	0.56	-9.94E-001
gmncase3	13	0.6	1.53	13	0.6	1.53E+000
goffin	11	0.02	2.39E-007	11	0.04	2.39E-007
gottfr	12	0	0	12	0	0
gouldqp2	29	0.07	0	29	0.07	0
gouldqp3	17	0.05	2.07	17	0.12	2.07
gpp	19	2	14400.94	20	2.67	14400.96
gridneta	26	1.2	304.98	26	1.23	3.05E+002
gridnetb	2	0.38	143.32	2	0.39	1.43E+002
gridnetc	28	1.97	161.88	28	2.03	1.62E+002
gridnetd	28	2.22	566.44	28	2.37	5.66E+002
gridnete	13	2.25	206.55	13	2.36	2.07E+002
gridnetf	28	4.71	242.11	28	4.93	242.11
gridnetg	12	0	73.32	12	0.01	7.33E+001
gridneth	10	0	39.63	10	0.01	39.63
gridneti	14	0.01	40.25	14	0.01	4.02E+001
grouping	12	0.01	13.85	12	0.04	13.85
growth	65	0	1	65	0.01	1.00E+000
growthls	68	0.01	1	68	0.01	1
gulf	20	0.01	2.15E-016	20	0.02	2.15E-016
hadamals	345	1.44	25.32	345	1.44	25.32
hadamard	9	0.01	1	9	0.03	1
hager1	9	0.45	0.88	9	0.46	0.88
hager2			(IL)			(IMP)
hager3			(IL)			(IMP)
hager4			(IL)	824	84.91	2.79E+000
haifam	2964	12.78	-45	27	0.05	-45
haifas	51	0	-0.45	19	0	-0.45
hairy	39	0	20	39	0	20
haldmads	42	0.01	0.03	42	0.04	0.03
hanging	32	0.07	-620.18	18	0.12	-620.18
harkerp2	28	0.05	-0.5	28	0.13	-0.5
hart6	11	0	-3.32	11	0	-3.32
hatflda	8	0	1.62E-015	8	0	1.62E-015
hatfldb	11	0	0.01	11	0	0.01
hatfldc	7	0	2.11E-016	7	0	2.11E-016
hatfldd	20	0	6.62E-008	20	0	6.62E-008
hatflde	23	0	4.43E-007	23	0	4.43E-007
hatfldf	18	0	0	18	0	0
hatfldg	9	0	0	10	0.01	7.06E-003
hatfldh	26	0	-24.5	26	0	-24.5
heart6	513	0.11	0	168	0.06	0

TABLE 5. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
heart6ls	758	0.07	6.27E-008	21	0	0.42
heart8	36	0.01	0	36	0.01	0
heart8ls	146	0.02	3.51E-012	146	0.06	3.51E-012
helix	12	0	2.32E-013	12	0	2.32E-013
helsby	86	1.49	31.94	86	1.51	3.19E+001
het-z	44	0.1	1	44	0.1	1
hilberta	2	0	1.17E-014	2	0	1.17E-014
hilbertb	2	0	1.99E-019	2	0.01	1.99E-019
himmelbb	8	0	1.42E-015	8	0	1.42E-015
himmelbc	8	0	0	8	0	0
himmelbd			(IL)			(INF)
himmelbf	11	0	318.57	11	0	318.57
himmelbg	6	0	3.00E-017	6	0	3.00E-017
himmelbh	23	0	-1	23	0	-1
himmelbi	23	0.01	-1755	23	0.02	-1755
himmelbj	71	0.03	-1910.34	71	0.07	-1910.34
himmelbk	21	0.01	0.05	21	0.03	0.05
himmelp1	13	0	-62.05	13	0	-62.05
himmelp2	18	0	-62.05	18	0	-62.05
himmelp3	16	0	-59.01	16	0	-5.90E+001
himmelp4	21	0	-59.01	33	0.01	-59.01
himmelp5	49	0	-59.01	41	0.01	-59.01
himmelp6	26	0	-59.01	26	0	-59.01
hong	19	0	1.35	19	0	1.35
hs001	31	0	7.67E-019	31	0	7.67E-019
hs002	29	0	4.94	29	0	4.94
hs003	11	0	2.45E-009	11	0	2.45E-009
hs004	10	0	2.67	8	0	2.67
hs005	10	0	-1.91	10	0	-1.91
hs006	8	0	3.57E-016	8	0	3.57E-016
hs007	14	0	-1.73	14	0	-1.73E+000
hs008	8	0	-1	8	0	-1
hs009	6	0	-0.46	6	0	-0.46
hs010	31	0	-1	14	0	-1.00E+000
hs011	12	0	-8.5	12	0	-8.50E+000
hs012	13	0	-30	16	0	-30
hs013			(IL)	251	0.01	9.91E-001*
hs014	10	0	1.39	10	0	1.39
hs015	18	0	306.5	18	0	306.5
hs016	12	0	0.25	12	0	2.50E-001
hs017	13	0	1	13	0	1
hs018	14	0	5	14	0	5
hs019	20	0	-6961.81	18	0	-6961.81
hs020	14	0	38.2	14	0	38.2
hs021	13	0	-99.96	13	0	-99.96
hs022	9	0	1	9	0	1
hs023	15	0	2	15	0	2
hs024	13	0	-1	13	0	-1.00E+000
hs025	1	0	32.84	1	0	32.84
hs026	17	0	1.77E-010	17	0	1.77E-010
hs027	15	0	0.04	28	0	0.04
hs028	2	0	1.99E-019	2	0	1.99E-019
hs029	12	0	-22.63	18	0	-22.63
hs030	8	0	1	8	0	1
hs031	11	0	6	15	0	6
hs032	21	0	1	21	0	1
hs033	18	0	-4.59	29	0.01	2
hs034	15	0	-0.83	15	0	-0.83
hs035	10	0	0.11	10	0	0.11

TABLE 6. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
hs036	16	0	-3300	16	0	-3300
hs037	11	0	-3456	11	0	-3456
hs038	41	0.01	1.78E-020	39	0	1.83E-019
hs039	1	0	-1	1	0	-1
hs040	11	0	-0.25	11	0	-2.50E-001
hs041	9	0	1.93	9	0	1.93
hs042	9	0	13.86	9	0	13.86
hs043	15	0	-44	16	0	-44
hs044	17	0	-15	16	0	-15
hs045	1	0	2	1	0	2
hs046	17	0	3.63E-010	17	0	3.63E-010
hs047	21	0	4.33E-011	21	0	4.33E-011
hs048	2	0	2.32E-028	2	0	2.32E-028
hs049	17	0	6.70E-009	17	0	6.70E-009
hs050	15	0	4.00E-014	15	0	4.00E-014
hs051	2	0	5.35E-017	2	0	5.35E-017
hs052	2	0	5.33	2	0	5.33
hs053	9	0	4.09	9	0	4.09
hs054	11	0	0.19	11	0	0.19
hs055	10	0	6.33	10	0	6.33E+000
hs056	10	0	-3.46	10	0	-3.46
hs057	20	0	0.03	15	0	0.03
hs059	19	0	-7.8	19	0	-7.8
hs060	10	0	0.03	10	0	0.03
hs061	11	0	-143.65	11	0	-143.65
hs062	13	0	-26272.51	13	0	-26272.51
hs063	9	0	961.72	9	0	961.72
hs064	27	0	6299.84	27	0	6299.84
hs065	14	0	0.95	18	0	0.95
hs066	14	0	0.52	14	0	0.52
hs067			(IL)			(IMP)
hs070	24	0.01	0.01	24	0.02	0.01
hs071	12	0	17.01	12	0	17.01
hs072	19	0	727.68	42	0.01	727.68
hs073	18	0	29.89	18	0	29.89
hs074	16	0	5126.5	16	0	5126.5
hs075	17	0	5174.41	17	0	5174.41
hs076	11	0	-4.68	11	0	-4.68
hs077	11	0	0.24	11	0	0.24
hs078	8	0	-2.92	8	0	-2.92E+000
hs079	7	0	0.08	7	0	0.08
hs080	9	0	0.05	9	0	0.05
hs083	14	0	-30665.54	14	0	-30665.54
hs084	42	0	-5280335.13	132	0.03	-5.28E+006
hs085	30	0.01	-1.91	29	0.02	-1.91
hs086	14	0	-32.35	14	0	-32.35
hs087	27	0	8827.6	27	0.01	8827.6
hs088	25	0.01	1.36	25	0.04	1.36
hs089	41	0.03	1.36	41	0.08	1.36
hs090	68	0.07	1.36	68	0.07	1.36
hs091	26	0.04	1.36	26	0.09	1.36E+000
hs092	25	0.05	1.36	25	0.12	1.36
hs093	13	0	135.08	12	0	135.08
hs095	15	0	0.02	15	0	0.02
hs096	18	0	0.02	18	0	0.02
hs097	17	0	4.07	17	0	4.07
hs098	44	0	3.14	44	0.01	3.14
hs099	23	0	-831079891.5	23	0.01	-8.31E+008
hs100	10	0	680.63	25	0.01	680.63

TABLE 7. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
hs100lnp	10	0	680.63	22	0	6.81E+002
hs100mod	15	0	678.75	23	0.01	678.75
hs101	38	0.01	1809.76	38	0.02	1.81E+003
hs102	55	0.01	911.88	55	0.04	911.88
hs103	47	0.01	543.67	72	0.05	543.67
hs104	13	0	3.95	13	0	3.95E+000
hs105	19	0.23	1137.96	19	0.11	1137.96
hs106	24	0	7049.25	24	0.01	7049.25
hs107	14	0	5055.01	13	0	5055.01
hs108	16	0	-0.67	16	0.01	-0.67
hs109	24	0	5326.85	24	0.01	5326.85
hs110	8	0	-45.78	8	0	-45.78
hs111	17	0	-47.76	20	0.01	-47.76
hs111lnp	25	0	-47.76	25	0.01	-47.76
hs112	16	0	-47.76	16	0	-47.76
hs113	17	0	24.31	20	0.01	24.31
hs114	25	0	-1768.81	25	0.01	-1768.81
hs116	52	0.01	97.59	52	0.02	97.59
hs117	20	0	32.35	20	0.01	3.23E+001
hs118	16	0	664.82	16	0	664.82
hs119	22	0	244.9	22	0.01	2.45E+002
hs21mod	20	0	-95.96	20	0	-95.96
hs268	15	0	2.97E-008	15	0	2.97E-008
hs35i	10	0	0.11	10	0	0.11
hs35mod	15	0	0.25	15	0	0.25
hs3mod	7	0	1.56E-008	7	0	1.56E-008
hs44new	20	0	-15	20	0	-15
hs76i	11	0	-4.68	11	0	-4.68
hs99exp	260	0.06	-1008062500	260	0.06	-1008062500
hubfit	10	0	0.02	10	0	0.02
hues-mod	216	7.55	34824480.48	216	7.98	34824480.48
huestis	1009	29.05	348244760500	1009	31.06	348244760500
humps	144	0.01	2.08E-012	144	0.01	2.08E-012
hvycrash	67	0.15	-0.22	128	0.6	-2.18E-001*
hydc20ls	17	0.04	36.81	17	0.11	36.81
hydcar20			(IL)			(IL)
hydcar6			(IL)			(IMP)
hydroell	66	1.34	-3585546.83	66	1.38	-3585546.83
hydroelm	42	0.35	-3582015.53	42	0.35	-3582015.53
hydroels	34	0.05	-3582268.34	34	0.05	-3.58E+006
hypcir	7	0	0	7	0	0
integreq	6	0.18	0	6	0.18	0
jannson3	10	5.6	19998.52	10	5.63	19998.52
jannson4	10	5.61	19998.52	10	5.63	19998.52
jensmp	9	0	124.36	9	0	124.36
jnlbrng1	14	3.14	-0.18	14	3.34	-0.18
jnlbrng2	14	3.14	-4.15	14	3.33	-4.15
jnlbrnga	14	3.13	-0.27	14	3.31	-0.27
jnlbrngb	16	3.56	-6.28	16	3.77	-6.28
junkturn	37	3.53	6.96E-009	37	3.61	6.96E-009
kissing	27	0.49	1	27	0.48	1
kissing2	100	0.82	3.86	100	0.82	3.86
kiwcresc			(IL)	109	0.01	-3.20E-014
kowosb	8	0	0	8	0	3.08E-004
ksip	47	0.39	0.58	47	0.38	0.58
lakes	373	0.16	350525.88	373	0.16	350525.88
launch			(IL)			(IMP)
lch	29	5.48	-4.32	29	5.53	-4.32
leaknet	48	0.05	8	48	0.06	8

TABLE 8. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
lewispol			(IL)			(INF)
lhaifam			(IL)			(IMP)
liarwhd	12	1.35	1.24E-009	12	1.38	1.24E-009
lin	7	0	-0.02	7	0	-1.76E-002
linspanh	10	0	-77	10	0.01	-77
liswet1			(IL)			(IL)
liswet10	10	0.46	25	10	0.49	25
liswet11	10	0.47	25	10	0.48	25
liswet12			(IL)			(IMP)
liswet2	10	0.46	25	10	0.48	25
liswet3	10	0.48	25	10	0.48	25
liswet4	10	0.48	25	10	0.48	25
liswet5	10	0.48	25	10	0.48	25
liswet6	10	0.48	25	10	0.48	25
liswet7	10	0.47	25	10	0.49	25
liswet8	10	0.47	25	10	0.48	2.50E+001
liswet9			(IL)			(IMP)
loadbal	21	0.01	0.45	21	0.01	0.45
loghairy	511	0.02	0.18	514	0.04	0.18
logros	1	0	0	1	0	0
lootsma	18	0	1.41	28	0	8
lotschd	15	0	2398.42	15	0	2.40E+003
lsnnodoc	17	0	123.11	17	0	123.11
lsqfit	9	0	0.03	9	0	0.03
lubrif			(IL)			(IMP)
lubrifc			(IL)			(IMP)
lukvle1	21	27.81	6.23	21	27.47	6.23E+000
lukvle10	56	51.45	17677.24	56	51.2	17677.24
lukvle11	9	4.86	2.48E-010	9	5.12	2.48E-010
lukvle12	16	7.8	77204.4	16	8.3	77204.4
lukvle13	13	5.42	401792.58	13	5.78	401792.58
lukvle14	25	11.28	380424.85	25	12.02	3.80E+005
lukvle15	49	23.24	3.61E-013	49	24.44	3.61E-013
lukvle16	13	5.41	2.00E-007	13	5.75	2.00E-007
lukvle17	14	5.85	71433.33	14	6.21	71433.33
lukvle18	12	5.05	59982.1	12	5.32	59982.1
lukvle2	22	37.51	1409237.18	22	37.8	1409237.18
lukvle3	15	4.68	65.12	15	5.08	65.12
lukvle4	22	21.9	242907.68	22	22.27	242907.68
lukvle5	25	31.09	9.96E-012	25	31.39	9.96E-012
lukvle6	34	56.72	3144226.08	34	55.96	3144226.08
lukvle7	26	10.6	-66139.62	26	11.11	-66139.62
lukvle8	121	114.99	5023600.76	121	114.52	5.02E+006
lukvle9	15	2.89	4994.67	15	3.12	4.99E+003
lukvli1			(IL)			(IL)
lukvli10	33	24.49	17677.25			(IL)
lukvli11	14	7.87	0	14	7.88	0
lukvli12	20	9.75	4.13E-007	20	9.77	4.13E-007
lukvli13	14	5.83	9.17E-005	14	5.85	9.17E-005
lukvli14	26	14.22	380424.85	32	40.58	380424.88
lukvli15	34	14.49	5.87	34	14.42	5.87
lukvli16	20	8.19	0	20	8.26	2.81E-004
lukvli17	60	35.23	8.16	27	18.88	0
lukvli18	20	11.2	0	26	17.7	0
lukvli2	16	27.1	1326656.17	16	27.18	1326656.17
lukvli3	12	4.05	11.58	12	4.05	11.58
lukvli4	22	21.89	20102.78	22	21.14	20102.78
lukvli5			(IL)			(IL)
lukvli6	59	97.29	3144226.08	59	93.84	3144226.08

TABLE 9. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
lukvli7	17	7.07	-18633.85	17	7.07	-18633.85
lukvli8	59	52.32	5023587.97	59	51.96	5023587.97
lukvli9	21	5.32	4994.67	110	28.42	4.99E+003
madsen	22	0	0.62	22	0	0.62
madsschj	39	0.31	-797.28	28	0.23	-797.28
makela1	12	0	-1.41	12	0	-1.41E+000
makela2	19	0	7.2	19	0	7.2
makela3	30	0	4.65E-012	15	0.01	1.39E-007
makela4	10	0	1.25E-006	10	0	1.25E-006
mancino	4	0.25	0	4	0.26	1.22E-004
maratos	18	0	-1	9	0	-1
maratosb	10	0	-1	10	0	-1
marine	33	4.62	19746526.17	33	4.69	19746526.17
matrix2	18	0	5.37E-009	18	0	5.37E-009
maxlika	19	0.22	1137.96	19	0.11	1137.96
mccormck	11	4.62	-45661.61	9	3.36	-45661.61
mconcon	81	0.01	-6230.8	81	0.02	-6230.8
mdhole	12	0	3.57E-009	12	0	3.40E-010
mesh			(IL)			(IL)
methanb8	21	0.02	3.31E-007	21	0.05	3.31E-007
methanl8	74	0.07	4.22E-007	75	0.07	4.72E-006
methanol	30	25.27	0.01			(IL)
mexhat	4	0	-0.04	4	0	-0.04
meyer3	6	0	53664.43	6	0	53664.43
mifflin1	31	0	-1	13	0	-1
mifflin2	35	0	-1	17	0	-1
minc44			(IL)			(IMP)
minmaxbd	54	0.01	115.71	54	0.01	115.71
minmaxrb	12	0	8.99E-010	12	0	8.99E-010
minperm	38	32.75	0	38	32.99	0
minsurf	5	0	1	5	0	1
minsurfo	16	1.09	2.51	16	1.15	2.51
mistake	13	0	-1	13	0	-1
model	13	0	5742.16	13	0.01	5.74E+003
morebv	1	0.04	1.04E-011	1	0.06	1.04E-011
mosarqp1	14	0.16	-952.84	14	0.16	-952.84
mosarqp2	18	0.13	-1597.47	18	0.13	-1597.47
mribasis	37	0.02	18.22	37	0.06	1.82E+001
msqrta	13	38.96	0	13	40.17	0
msqrtals	22	154.03	9.58E-005	22	139.85	9.58E-005
msqrtb	12	37.24	0	12	38.36	0.00E+000
msqrtbls	18	104.08	0	18	93.79	0
mss1			(IL)			(IL)
mss2			(IL)			(IMP)
mwright	13	0	24.98	13	0	24.98
nasty	2	0	5.00E-021	2	0	5.00E-021
ncb20	6	0.95	1668.91	6	0.95	1.67E+003
ncb20b	8	1.28	1721.84	8	1.29	1721.84
ncvxbqp1	671	258.39	-19855438460	671	260.13	-19855438460
ncvxbqp2	441	173.85	-13306917640	441	173.81	-1.33E+010
ncvxbqp3	323	132.65	-6518381652	320	124.15	-6.52E+009
ncvxqp1	422	47.96	-71591692.69	422	47.79	-7.16E+007
ncvxqp2	208	22.74	-57813850.51	208	23	-57813850.51
ncvxqp3	151	16.21	-31185245.67	151	16.37	-31185245.67
ncvxqp4	398	26.28	-93978793.51	398	26.24	-93978793.51
ncvxqp5	211	13.54	-66292771.93	211	13.59	-66292771.93
ncvxqp6	131	8.11	-35154798.53	131	8.13	-35154798.53
ncvxqp7	459	60.98	-43524296.28	459	61.29	-43524296.28
ncvxqp8	190	23.84	-30457329.82	190	23.95	-30457329.82

TABLE 10. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
ncvxqp9	117	14.08	-21570370.59	117	14.15	-21570370.59
net1	67	0.01	941194.32	67	0.04	941194.32
net2	65	0.05	992027.31	65	0.12	992027.31
net3	196	0.68	5859393.7	196	0.62	5.86E+006
ngone	282	5.9	-0.64	282	5.89	-0.64
nlmsurf	42	31.65	39.06	42	30.92	39.06
nobndtor	29	5.54	-0.44	29	5.78	-0.44
noncvxu2	287	68.47	2317.04	287	68.28	2317.04
noncvxun	55	0.2	2316.81	55	0.19	2316.81
nondia	3	0.56	0	3	0.57	3.30E-004
nondquar	22	1.28	1.62E-011	22	1.3	1.62E-011
nonmsqrt	279	0.02	0.75	279	0.04	0.75
nonscomp	24	1.97	2.20E-006	28	2.23	3.47E-007
nuffield			(IL)			(IL)
nuffield_continuum	9	0	2.55	9	0	2.55E+000
nuffield2			(IL)			(IL)
nuffield2_trap	59	129.39	5.2	59	123.72	5.2
nystrom5			(IL)			(IMP)
obstclae	39	8.89	1.9	39	8.91	1.9
obstclal	24	0.02	1.4	24	0.02	1.4
obstclbl	13	0.01	2.88	13	0.01	2.88
obstclbm	26	5.79	7.28	26	5.81	7.28
obstclbu	14	0.01	2.88	14	0.01	2.88
odfits	14	0	-2380.03	14	0	-2380.03
oet1	13	0.03	0.54	13	0.09	0.54
oet2	49	0.18	0.09	49	0.19	8.72E-002
oet3	13	0.04	0	13	0.11	0
oet4	41	0.23	0	41	0.22	0
oet5	62	0.23	0	62	0.23	0
oet6	114	1.05	0	114	1.03	0
oet7	152	2.39	4.48E-005	152	2.44	4.48E-005
optcdeg2	67	0.3	229.57	67	0.31	229.57
optcdeg3	42	0.21	46.15	42	0.21	46.15
optcntrl	42	0.01	550	42	0.02	550
optctrl3	33	0.04	2048.01	33	0.04	2.05E+003
optctrl6	33	0.04	2048.01	33	0.04	2048.01
optmass	20	0.01	-0.19	20	0.03	-0.19
optprloc	21	0	-16.42	21	0.01	-16.42
orthrdm2	12	1.27	155.53	12	1.32	1.56E+002
orthrds2	82	0.11	30.54	82	0.11	30.54
orthrega	56	0.39	1414.06	56	0.41	1414.06
orthregb	11	0.01	4.38E-014	14	0.02	0.02
orthregc	14	6.51	189.59	33	12.67	189.61
orthregd	11	4.51	1523.9	11	4.63	1523.9
orthrege	16	0	0.79	16	0.01	0.79
orthregf	77	6.53	75.03	79	6.96	79.55
orthrgdm	15	5.47	1513.8	15	5.64	1513.8
orthrgds	98	20.58	1630.81	98	21.66	1630.81
osbornea	22	0	5.46E-005	22	0.01	5.46E-005
osborneb	14	0.01	0.04	14	0.03	0.04
oslbqp	21	0	6.25	21	0	6.25
palmer1	14	0	11754.6	15	0	11754.6
palmer1a	39	0	0.09	62	0.02	8594.14
palmer1b	25	0	3.45	34	0.01	14383.6
palmer1c	2	0	0.1	2	0	0.1
palmer1d	2	0	0.65	2	0	0.65
palmer1e	106	0.02	0.12	107	0.04	0.11
palmer2	12	0	3651.1	12	0	3651.1
palmer2a	66	0.01	0.02	93	0.02	5034.46

TABLE 11. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
palmer2b	19	0	0.62	160	0.03	1379.78
palmer2c	2	0	0.01	2	0	0.01
palmer2e	13	0	0.04	13	0	0.04
palmer3	18	0	2265.96	71	0.02	2265.96
palmer3a	99	0.01	0.02	256	0.06	0.02
palmer3b	19	0	4.23	19	0	4.23
palmer3c	2	0	0.02	2	0	0.02
palmer3e	4	0	0.03	4	0	0.03
palmer4	22	0	2285.38	18	0	2285.38
palmer4a	64	0	0.04	61	0.01	2528.45
palmer4b	21	0	6.84	21	0	6.84
palmer4c	2	0	0.05	2	0	0.05
palmer4e	13	0	0.07	13	0	0.07
palmer5a			(IL)	855	0.08	2.13
palmer5b	106	0.01	0.01	94	0.02	0.01
palmer5c	2	0	2.13	2	0	2.13
palmer5d	2	0	87.34	2	0	87.34
palmer5e			(IL)			(IL)
palmer6a	102	0.01	0.06	105	0.02	0.06
palmer6c	2	0	0.02	2	0	0.02
palmer6e	88	0.01	0	190	0.04	0
palmer7a	3324	0.22	10.33	145	0.01	24.95
palmer7c	2	0	0.6	2	0	0.6
palmer7e			(IL)	484	0.05	10.14
palmer8a	49	0	0.07	71	0.01	0.07
palmer8c	2	0	0.16	2	0	0.16
palmer8e	22	0	0.01	22	0	0.01
penalty1	40	38.69	0.01	40	35.58	9.69E-003
penalty2	19	0.03	97096.08	19	0.09	97096.08
penalty3	11	1.57	0	11	1.61	1.00E-003
pentagon	24	0	0	29	0.01	1.37E-004
pentdi	16	0.06	-0.75	16	0.05	-0.75
pfit1	46	0	0	46	0.01	0
pfit1ls	46	0	0	46	0.01	0
pfit2	14	0	0	14	0	0
pfit2ls	14	0	0	14	0	0
pfit3	15	0	0	15	0	0
pfit3ls	15	0	0	15	0	0
pfit4	18	0	0.01	18	0	0.01
pfit4ls	18	0	0.01	18	0	0.01
pinene	43	9.01	19.87	43	9.31	19.87
polak1	11	0	2.72	11	0	2.72
polak2	12	0	54.6	12	0	54.6
polak3	33	0.01	5.93	33	0.02	5.93
polak4	10	0	-7.02E-009	10	0	-7.02E-009
polak5			(IL)	48	0.01	50
polak6			(IL)	20	0.01	-44
polygon	70	1.48	0.78	70	1.5	7.79E-001
porous1	18	3.42	0	18	3.51	0.00E+000
porous2	14	2.59	0	14	2.67	0.00E+000
portfl1	17	0	0.02	17	0.01	0.02
portfl2	18	0	0.03	18	0.01	0.03
portfl3	18	0	0.03	18	0.01	0.03
portfl4	17	0	0.03	17	0.01	0.03
portfl6	16	0	0.03	16	0.01	0.03
portsnqp	39	0.11	331.78	39	0.11	331.78
portsqp	13	0.03	331.42	13	0.06	331.42
powell20	352	1.05	52145781.25	352	1.04	52145781.25
powellbs	30	0	0	30	0	0

TABLE 12. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
powellsg	18	0	1.71E-010	18	0	1.71E-010
powellsq	65	0	0			(INF)
power	2	0	4.11E-021	2	0.01	4.11E-021
primal1	27	0.28	-0.04	27	0.27	-0.04
primal2	19	0.73	-0.03	19	0.71	-0.03
primal3	33	8.33	-0.14	33	8.51	-0.14
primal4	18	25.45	-0.75	18	27.37	-0.75
primalc1	32	0.31	-6155.24	32	0.3	-6.16E+003
primalc2	69	0.63	-3551.3	69	0.62	-3.55E+003
primalc5	39	0.66	-427.23	39	0.65	-4.27E+002
primalc8	63	5.95	-18309.43	63	5.93	-18309.43
probpenl	29	6.49	-3.49E-005	29	6.59	-3.49E-005
prodpl0	18	0	60.92	18	0.01	60.92
prodpl1	18	0	53.04	18	0.01	53.04
pspdoc	8	0	2.41	8	0	2.41
pt	13	0.01	0.18	13	0.03	0.18
qc	46	0	-964.88	46	0.01	-964.88
qcnew	42	0	-899.74	42	0.01	-899.74
qpcblend	33	0.02	-0.01	33	0.04	-0.01
qpcboei1	64	0.14	14433867.28	64	0.14	14433867.28
qpcboei2	102	0.08	8293665.51	102	0.08	8293665.51
qpcstair	190	0.7	6204390.86	190	0.67	6204390.86
qpnblend	32	0.02	-0.01	32	0.05	-0.01
qpnboei1	1971	9.79	8514857.63	1971	9.79	8514857.63
qpnboei2	168	0.3	1271825.87	168	0.29	1271825.87
qpnstair	228	1.47	5146033.08	302	2.03	5146033.08
qr3d	46	0.53	8.14E-016	117	1.23	2.19E-017
qr3dbd	36	0.25	9.23E-018	179	1.25	3.40E-016
qr3dls	47	0.65	1.15E-017	212	3.13	2.11E-016
qrtquad	25	0.01	-3647530.29	25	0.03	-3647530.29
quartc	24	0.79	1259.82	24	0.81	1.26E+003
qudlin	23	0	-7200	23	0	-7200
raybendl	1	0.02	98.03	1	0.04	98.03
reading1			(IL)	1184	179.38	-0.16
reading2	22	1.65	-0.01	22	1.73	-0.01
reading3			(IL)			(IMP)
reading4	555	54.59	-0.29			(IL)
reading5	36	2.78	1.49E-015	36	2.87	1.49E-015
reading6	24	0.06	-144.66	24	0.04	-144.66
reading7	182	424.41	-1346.33	675	1486.31	-1414.79
reading9	85	9.29	-0.04	85	9.92	-0.04
res	11	0	0	11	0	0
rk23	4512	1.24	0.44	95	0.04	1.48
robot	17	0	6.59	17	0	6.59
robotarm			(IL)	226	59.89	9.14E+000
rocket	27	10.69	1.01	27	11.13	1.01
rosenbr	21	0	8.52E-012	21	0	8.52E-012
rosenmmx	31	0	-44	16	0	-44
rotdisc	309	4.17	7.87	72	0.87	7.87
s201	2	0	2.81E-020	2	0	2.81E-020
s202	7	0	48.98	7	0	48.98
s203	7	0	2.36E-014	7	0	2.36E-014
s204	5	0	0.18	5	0	1.84E-001
s205	12	0	1.17E-016	12	0	1.17E-016
s206	4	0	7.73E-012	4	0	7.73E-012
s207	7	0	1.18E-012	7	0	1.18E-012
s208	21	0	8.52E-012	21	0	8.52E-012
s209	79	0	5.70E-009	79	0.01	1.58E-009
s210	2	0	4.84	2	0	4.84

TABLE 13. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
s211	27	0	4.04E-014	27	0	4.04E-014
s212	9	0	1.94E-017	9	0	1.94E-017
s213	30	0	1.10E-009	30	0	1.10E-009
s215	13	0	2.02E-009	13	0	2.02E-009
s216	12	0	1	12	0	1
s217	17	0	-0.8	17	0	-8.00E-001
s218	15	0	2.63E-008	16	0	1.27E-007
s219	26	0	-1	15	0	-1
s220			(IL)	74	0.01	1
s221			(IL)	166	0.01	-1.00E+000*
s222	10	0	-1.5	10	0	-1.5
s223	11	0	-0.83	11	0	-8.34E-001
s224	11	0	-304	11	0	-304
s225	12	0	2	12	0	2
s226	9	0	-0.5	9	0	-0.5
s227	10	0	1	10	0	1
s228	14	0	-3	18	0	-3
s229	25	0	1.66E-019	25	0	1.66E-019
s230	10	0	0.37	10	0	0.37
s231	26	0	7.87E-011	26	0	7.87E-011
s232	12	0	-1	12	0	-1.00E+000
s233	14	0	2.03E-012	18	0	2.31E-010
s234	17	0	-0.8	17	0	-8.00E-001
s235	20	0	0.04	20	0	0.04
s236	19	0	-58.9	19	0	-58.9
s237	70	0	-58.9	40	0.01	-5.89E+001
s238	43	0	-8.2	73	0.01	-8.2
s239	15	0	-58.9	15	0	-58.9
s240	2	0	1.27E-017	2	0	1.27E-017
s241	13	0	3.35E-012	13	0	3.35E-012
s242	24	0	4.58E-009	24	0	4.58E-009
s243	5	0	0.8	5	0	0.8
s244	21	0.01	6.73E-011	21	0	6.73E-011
s245	13	0	5.36E-014	13	0	5.36E-014
s246	10	0	5.95E-012	10	0	5.95E-012
s247	11	0	2.13E-018	11	0	2.13E-018
s248	57	0	-0.8	15	0	-8.00E-001
s249	17	0	1	23	0	1.00E+000
s250	16	0	-3300	16	0	-3.30E+003
s251	11	0	-3456	11	0	-3456
s252	20	0	0.04	20	0	0.04
s253	12	0	69.28	12	0	69.28
s255			(IL)			(IL)
s256	18	0	1.71E-010	18	0	1.71E-010
s257	9	0	1.28E-018	9	0	1.28E-018
s258	38	0	4.67E-011	38	0	4.67E-011
s259	12	0	-8.54	12	0	-8.54E+000
s260	38	0	4.52E-011	38	0	4.52E-011
s261	14	0	3.06E-009	14	0	3.06E-009
s262	12	0	-10	12	0	-10
s263	19	0	-1	19	0	-1
s264	15	0	-44.11	16	0	-44.11
s265	12	0	1.9	12	0	1.90E+000
s266	8	0	1	8	0	1
s267	23	0	1.86E-012	23	0.01	1.86E-012
s268	15	0	2.98E-008	15	0	2.98E-008
s269	2	0	4.09	2	0	4.09
s270	11	0	5.56E-009	11	0	5.56E-009
s271	2	0	1.22E-022	2	0	1.22E-022

TABLE 14. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
s272	97	0.01	0.24	107	0.04	2.43E-001
s272a	46	0.01	1.17E-012	46	0.03	1.17E-012
s273	11	0	7.01E-018	11	0	7.01E-018
s274	2	0	4.00E-020	2	0	4.00E-020
s275	2	0	4.00E-020	2	0	4.00E-020
s276	2	0	4.02E-020	2	0	4.02E-020
s277	11	0	5.08	11	0	5.08
s278	11	0	7.84	11	0	7.84
s279	11	0	10.61	11	0	10.61
s280	11	0	13.38	11	0	1.34E+001
s281	23	0	0	23	0.01	0
s281a	2	0	2.99E-021	2	0	2.99E-021
s282	60	0	5.67E-009	60	0.01	5.67E-009
s283	36	0	1.23E-010	36	0	1.23E-010
s284	66	0.01	-1840	25	0.01	-1840
s285	56	0.01	-8251.49	17	0.01	-8251.49
s286	21	0	8.52E-011	21	0	8.52E-011
s287	38	0	1.84E-010	38	0.01	1.84E-010
s288	18	0	8.54E-010	18	0	8.54E-010
s289	4	0	0	4	0	0.00E+000
s290	2	0	3.75E-021	2	0	3.75E-021
s291	2	0	7.32E-021	2	0	7.32E-021
s292	2	0	9.99E-021	2	0	9.99E-021
s293	2	0	1.12E-020	2	0	1.12E-020
s294	20	0	3.97	20	0	3.97
s295	25	0	3.99	25	0	3.99
s296	34	0	3.99	34	0.01	3.99
s297	59	0.01	1.20E-008	59	0.01	1.20E-008
s298	89	0.01	9.47E-012	89	0.03	9.47E-012
s299	163	0.04	8.52E-015	163	0.11	8.52E-015
s300	2	0	-20	2	0	-20
s301	2	0	-50	2	0	-50
s302	2	0	-100	2	0	-1.00E+002
s303	12	0	1.12E-032	12	0	1.12E-032
s304	16	0.01	1.62E-020	16	0.02	1.62E-020
s305	20	0.03	1.24E-038	20	0.08	1.24E-038
s307	17	0	124.36	14	0	124.36
s308	10	0	0.77	10	0	0.77
s309	7	0	0.29	7	0	0.29
s311	6	0	1.96E-013	6	0	1.96E-013
s312	18	0	5.92	18	0	5.92E+000
s314	3	0	0.17	3	0	1.69E-001
s315	18	0	-0.8	18	0	-0.8
s316	15	0	334.31	15	0	334.31
s317	15	0	372.47	15	0	372.47
s318	16	0	412.75	16	0	412.75
s319	17	0	452.4	17	0	4.52E+002
s320	18	0	485.53	18	0	4.86E+002
s321	16	0	496.11	16	0	496.11
s322	17	0	499.96	17	0	499.96
s323	11	0	3.8	11	0	3.8
s324	17	0	5	17	0	5
s325	10	0	3.79	10	0	3.79
s326	14	0	-79.81	16	0	-79.81
s327	18	0	0.03	16	0.01	0.03
s328	12	0	1.74	8	0	1.74
s329	18	0	-6961.81	18	0	-6.96E+003
s330	14	0	1.62	14	0	1.62
s330a	14	0	1.62	14	0	1.62

TABLE 15. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
s331	7	0	4.26	7	0	4.26
s332			(IL)			(IL)
s332a	26	0.01	29.92	26	0.03	2.99E+001
s333	11	0	0.04	11	0	0.04
s334	8	0	0.01	8	0	0.01
s335	97	0	0	41	0.01	0
s336	129	0.01	-0.34	15	0	-3.38E-001
s337	14	0	6	20	0	6
s338	19	0	-10.99	19	0	-7.21E+000
s339	13	0	3.36	24	0	3.36
s340			(IL)			(IL)
s340a			(IL)			(IL)
s341	13	0	-22.63	16	0	-22.63
s342	23	0	-22.63	23	0	-22.63
s343	13	0	-5.68	13	0	-5.68
s344	9	0	0.03	9	0	0.03
s345	12	0	0.03	12	0	0.03
s346	13	0	-5.68	13	0	-5.68
s348			(IL)			(IMP)
s348a			(IL)			(IMP)
s350	8	0	0	8	0	0
s351	11	0	318.57	11	0	318.57
s352	2	0	903.23	2	0	903.23
s353	15	0	-39.93	15	0	-39.93
s354	17	0	0.11	17	0	0.11
s355			(IL)	380	0.07	122.21
s355a			(IL)	380	0.07	122.21
s356	36	0	1.88	36	0.01	1.88E+000
s357	11	0.02	0.36	11	0.06	0.36
s357a	11	0.03	0.36	11	0.07	0.36
s358	27	0.01	5.46E-005	24	0.01	5.46E-005
s359	12	0	-5504450.88	12	0	-5504450.88
s360	23	0	-5280335.13	61	0.01	-5280335.13
s361	27	0	-15260.16	27	0	-15260.16
s365	70	0.01	52.14	229	0.06	52.14
s365mod	27	0	52.14	27	0.01	52.14
s366	46	0.01	1226.97	46	0.01	1226.97
s367	32	0	-37.41	32	0.01	-37.41
s368	1	0	0	1	0	0
s368cute	1	0.12	0	1	0.09	0
s369	16	0	7049.25	16	0	7049.25
s370	12	0	0	12	0	0
s371	13	0	1.40E-006	13	0	1.40E-006
s372	58	0.01	13390.09	51	0.01	13390.09
s372a	357	0.05	23308.17	58	0.02	13390.09
s373	86	0.01	13390.09	78	0.02	13390.09
s374	44	0.03	0.23	44	0.07	0.23
s375	19	0	-15.16	19	0.01	-15.16
s376			(IL)			(IMP)
s377	78	0.01	-795	91	0.01	-795
s378	25	0.01	-47.76	25	0.01	-47.76
s379	14	0.01	0.04	14	0.03	0.04
s380	3227	1	3.17E-005	28	0.01	245161.05
s380a	3227	1	3.17E-005	28	0.01	245161.05
s381	14	0	1.01	14	0	1.01
s382	15	0	1.04	15	0	1.04
s383	19	0	728593.64	19	0	7.29E+005
s384	76	0.01	-8309.88	17	0.01	-8.31E+003
s385	56	0.01	-8314.95	20	0.01	-8314.95

TABLE 16. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
s386	2	0	2.81E-020	2	0	2.81E-020
s387	91	0.02	-8249.84	21	0.01	-8249.84
s388	63	0.01	-5821.08	21	0.02	-5.82E+003
s389	59	0.01	-5809.72	23	0.02	-5.81E+003
s391			(IL)			(IL)
s392	33	0.01	-1101200.34	33	0.01	-1101200.34
s393	78	0.04	0.87	78	0.11	0.87
s394	16	0	1.92	16	0	1.92
s395	18	0.01	1.92	18	0.02	1.92
sawpath	91	0.4	181.57	1031	7.77	181.57
sbrybnd	60	11.1	5.73E-012	60	11.22	5.73E-012
schmvett	3	0.49	-29994	3	0.49	-3.00E+004
scon1dls	230	2.41	6.24E-019	27	0.22	0.57
scosine	49	3.79	-3761.76	49	3.93	-3761.76
scurly10	53	11.47	-768330.5	53	11.52	-768330.5
scurly20	48	18.79	-775183.65	48	18.88	-775183.65
scurly30	42	26.07	-764877.3	42	26	-764877.3
semicon1	343	3.33	0	298	2.88	0.00E+000
semicon2	50	0.43	0	48	0.38	0
sim2bqp	11	0	8.64E-009	11	0	8.64E-009
simbqp	11	0	5.97E-009	11	0	5.97E-009
simpllpa	11	0	1	11	0	1
simpllpb	12	0	1.1	12	0	1.1
sineali			(IL)	29	0	-1900.96
sineval	43	0	1.90E-018	43	0	4.33E-035
sinquad	20	3.97	5.74E-012	22	4.92	2.92E-011
sinrosnb	4	0.04	-99901	4	0.09	-99901
sipow1	12	0.95	-1	12	0.96	-1
sipow1m	12	0.96	-1	12	0.97	-1
sipow2	12	0.29	-1	12	0.29	-1
sipow2m	12	0.29	-1	12	0.29	-1
sipow3	15	1.21	0.54	15	1.2	0.54
sipow4	14	1.51	0.27	14	1.51	2.73E-001
sisser	15	0	4.85E-010	15	0	4.85E-010
smbank	25	0.02	-7129292	25	0.04	-7129292
smmpsf	134	0.33	1046985.41	134	0.33	1046985.41
snail	65	0	5.37E-019	65	0.01	5.37E-019
snake			(IL)	51	0.01	6.71E-014
sosqp2	29	4.28	-4998.7	29	4.33	-4998.7
spanhyd	50	0.05	239.74	137	0.17	2.40E+002*
specan	22	3.61	1.66E-018	22	3.7	1.66E-018
spiral			(IL)	84	0.01	-6.89E-011
sreadin3	12	1.66	-4.03E-005	11	1.52	-3.80E-005
srosenbr	20	0.97	0	20	1	0
sseblin	12	0.01	16170600	12	0.02	16170600
ssebnln	51	0.03	16170600	51	0.08	16170600
ssnlbeam	63	0.02	337.77	63	0.04	337.77
stancmin	18	0	4.25	17	0	4.25E+000
static3			(IL)			(IMP)
stcqp1	19	0.36	155143.55	19	0.17	155143.55
stcqp2	20	0.62	22327.31	20	0.32	22327.31
steenbra	20	0.43	16957.68	20	0.44	16957.68
steenbrb			(IL)	660	38.41	9.54E+003*
steenbrd	156	6.21	9030.13	170	5.37	9030.5
steenbre	185	12.84	27459.66	562	27.66	3.20E+004*
steenbrf			(IL)	574	1.22	5.03E+002*
steenbrg	249	10.63	27421.24	592	30.15	2.80E+004*
steering	28	2.83	0.55	28	2.9	5.55E-001
stnqp1	31	0.68	-136156.5	31	0.31	-136156.5

TABLE 17. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by (∗).

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
stnqp2	37	2.04	-247639.5	37	0.93	-2.48E+005
supersim	10	0	0.67	10	0	0.67
svanberg	14	2.1	8361.49	14	2.15	8361.49
swopf	22	0.01	0.07	22	0.03	0.07
synthes1	16	0	0.76	16	0	7.59E-001
tame	9	0	0	9	0	0
tenbars1	22	0	2302.55	22	0.01	2302.55
tenbars2	20	0	2302.55	20	0.01	2302.55
tenbars3	21	0	2247.13	21	0.01	2247.13
tenbars4	16	0	2374.99	16	0.01	2374.99
testquad	2	0.01	9.14E-019	2	0.01	9.14E-019
tfi2	13	1.38	0.65	13	1.37	0.65
tfi3			(IL)			(IL)
tointgor	32	0.01	1373.91	32	0.03	1.37E+003
tointgss	2	0.21	10	2	0.22	10
tointpsp			(IL)			(IL)
tointqor	2	0	1175.47	2	0	1175.47
torsion1	23	4.8	-0.43	23	4.82	-0.43
torsion2	23	4.8	-0.43	23	4.81	-0.43
torsion3	21	4.5	-1.21	21	4.52	-1.21
torsion4	22	4.74	-1.21	22	4.76	-1.21
torsion5	21	4.62	-2.86	21	4.64	-2.86
torsion6	21	4.64	-2.86	21	4.64	-2.86
torsiona	21	4.41	-0.42	21	4.43	-0.42
torsionb	21	4.41	-0.42	21	4.42	-0.42
torsionc	22	4.77	-1.2	22	4.78	-1.2
torsiond	22	4.78	-1.2	22	4.78	-1.2
torsione	23	5.29	-2.85	23	5.29	-2.85
torsionf	23	5.28	-2.85	23	5.28	-2.85
tquartic	3	0.61	6.15E-026	3	0.62	6.15E-026
trainf			(IL)	4542	1112.92	3.1
trainh			(IL)			(IL)
tridia	2	0.07	2.19E-020	2	0.07	2.19E-020
trigger	57	0.01	0	40	0.01	7.95E-026
trimloss	34	0.02	9.06	34	0.06	9.06
truspyr1	17	0	11.23	17	0.01	11.23
truspyr2	16	0	11.23	16	0.01	11.23
try-b	16	0	7.89E-016	16	0	7.89E-016
twirimd1			(IL)	1004	1196.88	-1.03
twirism1	185	5.31	-1.01	185	5.36	-1.01
twobars	9	0	1.51	9	0	1.51
ubh1	7	0.65	1.12	7	0.68	1.12
ubh5	8	1.58	1.12	8	1.64	1.12E+000
vanderm1	2172	191.68	0	392	17.69	1.07E-023*
vanderm2			(IL)			(IMP)
vanderm3			(IL)	654	29.24	1736770.17
vanderm4	39	0.01	0	39	0.03	0.00E+000
vardim	24	0.03	0	24	0.09	0
vibrbeam	30	0.01	0.8	18	0.02	6.68
water	24	0	10549.38	24	0.01	1.05E+004
watson	13	0.01	6.08E-007	13	0.02	6.08E-007
weeds	6	0	9205.44	6	0	9205.44
womflet	16	0	6.05	16	0	6.05
woods	38	2.41	0	38	2.51	1.72E-004
yao	100	0.77	197.69			(IMP)
yfit	42	0	6.67E-013	42	0.01	6.67E-013
yfitu	36	0	7.71E-009	36	0.01	7.71E-009
yorknet	38	0.07	14239.97	38	0.07	14239.97
zamb2			(IL)	1693	25.05	-4.14

TABLE 18. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by (∗).

	DEFAULT			HYBRID		
Problem	Iters	Time	$f(x^*)$	Iters	Time	$f(x^*)$
zamb2-10	133	0.26	-1.58	133	0.26	-1.58
zamb2-11			(IL)			(IMP)
zamb2-8	61	0.05	-0.15	61	0.05	-0.15
zamb2-9	34	0.02	-0.35	34	0.06	-0.35
zangwil2	2	0	-18.2	2	0	-18.2
zangwil3	2	0	0	2	0	0
zecevic2	12	0	-4.12	12	0	-4.12
zecevic3	15	0	97.31	15	0	97.31
zecevic4	73	0	7.56	80	0.01	7.56
zigzag	37	0.01	3.16	37	0.03	3.16
zy2	12	0	2	12	0	2.00E+000

TABLE 19. Numerical comparison of the default code to the penalty code. (IL) signifies that the algorithm reached its iteration limit. (INF) signifies that the problem was determined to be locally infeasible. (IMP) signifies that the algorithm was far away from the solution and could not make further progress. The problems where the solution found had a lower level of accuracy than the default are denoted by $(*)$.