Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
dtoc1l-1	0.0001	20	6	2	7.55E-06	1.05E-03
dtoc1l-2	0.0001	22	6	2	9.44E-06	1.17E-03
dtoc1l-3	0.0001	17	6	2	8.82E-06	1.13E-03
dtoc1l-4	0.0001	15	6	2	7.87E-06	1.07E-03
dtoc1l-5	0.0001	19	6	2	7.10E-06	1.02E-03
dtoc1l-ave	0.0001	18.6	6.0	2.0	8.16E-06	1.09E-03
dtoc1l-1	0.001	20	6	3	7.53E-05	3.32E-03
dtoc1l-2	0.001	22	6	3	9.45E-05	3.72E-03
dtoc1l-3	0.001	17	6	3	8.82E-05	3.59E-03
dtoc1l-4	0.001	15	6	3	7.85E-05	3.39E-03
dtoc1l-5	0.001	19	6	3	7.05E-05	3.21E-03
dtoc1l-ave	0.001	18.6	6.0	3.0	8.14E-05	3.45E-03
dtoc1l-1	0.01	20	6	4	7.53E-04	1.06E-02
dtoc1l-2	0.01	22	6	4	9.45E-04	1.19E-02
dtoc1l-3	0.01	17	6	4	8.82E-04	1.15E-02
dtoc1l-4	0.01	15	6	4	7.85E-04	1.09E-02
dtoc1l-5	0.01	19	6	4	7.06E-04	1.03E-02
dtoc1l-ave	0.01	18.6	6.0	4.0	8.14E-04	1.11E-02
expfita-1	0.0001	1	19	13	1.87E-04	5.47E-02
expfita-2	0.0001	2	19	13	1.97E-04	5.61E-02
expfita-3	0.0001	2	19	13	2.23E-04	5.97E-02
expfita-4	0.0001	3	19	13	2.50E-04	6.32E-02
expfita-5	0.0001	3	19	13	2.76E-04	6.64E-02
expfita-ave	0.0001	2.2	19.0	13.0	2.27E-04	6.00E-02
expfita-1	0.001	1	19	14	1.95E-03	1.76E-01
expfita-2	0.001	2	19	13	2.04E-03	1.80E-01
expfita-3	0.001	2	19	14	2.31E-03	1.92E-01
expfita-4	0.001	3	19	13	2.45E-03	1.98E-01
expfita-5	0.001	3	19	14	2.84E-03	2.13E-01
expfita-ave	0.001	2.2	19.0	13.6	2.32E-03	1.92E-01
expfita-1	0.01	1	18	14	1.27E-02	4.50E-01
expfita-2	0.01	2	20	15	1.90E-02	5.50E-01
expfita-3	0.01	2	18	14	1.27E-02	4.51E-01
expfita-4	0.01	3	18	14	1.51E-02	4.91E-01
expfita-5	0.01	3	18	14	1.27E-02	4.51E-01
expfita-ave	0.01	2.2	18.4	14.2	1.44E-02	4.79E-01
expfitb-1	0.0001	11	23	19	1.89E-04	5.36E-02
expfitb-2	0.0001	11	21	19	6.34E-05	3.11E-02
expfitb-3	0.0001	11	22	19	2.48E-05	1.94E-02
expfitb-4	0.0001	9	21	19	3.31E-05	2.25E-02
expfitb-5	0.0001	9	22	19	4.75E-05	2.69E-02
expfitb-ave	0.0001	10.2	21.8	19.0	7.16E-05	3.07E-02
expfitb-1	0.001	11	23	19	2.30E-03	1.87E-01
expfitb-2	0.001	11	27	21	7.95E-04	1.10E-01
expfitb-3	0.001	11	24	19	3.49E-04	7.28E-02
expfitb-4	0.001	9	28	19	2.33E-04	5.95E-02
expfitb-5	0.001	9	24	19	3.71E-04	7.52E-02
expfitb-ave	0.001	10.2	25.2	19.4	8.10E-04	1.01E-01
expfitb-1	0.01	11	25	23	1.06E-02	4.02E-01
expfitb-2	0.01	11	19	25	7.83E-03	3.45E-01
expfitb-3	0.01	11	32	23	3.47E-03	2.30E-01
expfitb-4	0.01	9	23	26	2.23E-03	1.84E-01
expfitb-5	0.01	9	24	26	2.46E-02	6.12E-01
expfitb-ave	0.01	10.2	24.6	24.6	9.75E-03	3.55E-01

TABLE 1. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
expfitc-1	0.0001	16	31	31	5.06E-05	2.61E-02
expfitc-2	0.0001	22	30	32	2.87E-05	1.97E-02
expfitc-3	0.0001	27	29	33	1.03E-04	3.71E-02
expfitc-4	0.0001	25	31	31	2.43E-05	1.81E-02
expfitc-5	0.0001	25	33	35	6.29E-05	2.91E-02
expfitc-ave	0.0001	23.0	30.8	32.4	5.38E-05	2.60E-02
expfitc-1	0.001	16	37	27	2.06E-04	5.32E-02
expfitc-2	0.001	22	32	37	2.70E-04	6.12E-02
expfitc-3	0.001	27	36	36	6.57E-04	9.39E-02
expfitc-4	0.001	25	32	27	2.32E-04	5.65E-02
expfitc-5	0.001	25	34	39	2.77E-04	6.19E-02
expfitc-ave	0.001	23.0	34.2	33.2	3.29E-04	6.53E-02
expfitc-1	0.01	16	42	27	2.94E-03	2.01E-01
expfitc-2	0.01	22	38	31	3.29E-03	2.13E-01
expfitc-3	0.01	27	34	44	1.63E-02	4.79E-01
expfitc-4	0.01	25	33	32	8.23E-03	3.35E-01
expfitc-5	0.01	25	43	42	4.36E-03	2.44E-01
expfitc-ave	0.01	23.0	38.0	35.2	7.02E-03	2.94E-01
himmelbi-1	0.0001	1	22	1	3.12E-01	8.30E+01
himmelbi-2	0.0001	2	22	1	3.12E-01	8.30E+01
himmelbi-3	0.0001	1	22	1	3.12E-01	8.30E+01
himmelbi-4	0.0001	1	22	1	3.12E-01	8.30E+01
himmelbi-5	0.0001	1	22	2	3.39E-01	8.65E+01
himmelbi-ave	0.0001	1.2	22.0	1.2	3.17E-01	8.37E+01
himmelbi-1	0.001	1	22	1	3.12E-01	8.30E+01
himmelbi-2	0.001	2	22	16	3.31E-01	8.54E+01
himmelbi-3	0.001	1	22	1	3.12E-01	8.30E+01
himmelbi-4	0.001	1	22	1	3.12E-01	8.30E+01
himmelbi-5	0.001	1	22	26	3.12E-01	8.29E+01
himmelbi-ave	0.001	1.2	22.0	9.0	3.16E-01	8.34E+01
himmelbi-1	0.01	1	22	4	3.55E-01	8.85E+01
himmelbi-2	0.01	2	22	1	3.12E-01	8.30E+01
himmelbi-3	0.01	1	22	1	3.12E-01	8.30E+01
himmelbi-4	0.01	1	22	33	3.60E-01	8.91E+01
himmelbi-5	0.01	1	22	1	3.12E-01	8.30E+01
himmelbi-ave	0.01	1.2	22.0	8.0	3.30E-01	8.53E+01
himmelbj-1	0.0001	1	70	8	1.22E-03	2.36E-01
himmelbj-2	0.0001	2	70	8	1.22E-03	2.36E-01
himmelbj-3	0.0001	1	61	9	9.95E-04	2.41E-01
himmelbj-4	0.0001	3	65	8	1.24E-03	1.20E-01
himmelbj-5	0.0001	2	63	8	7.70E-04	2.30E-01
himmelbj-ave	0.0001	1.8	65.8	8.2	1.09E-03	2.13E-01
himmelbj-1	0.001	1	70	8	1.22E-03	2.36E-01
himmelbj-2	0.001	2	70	8	1.24E-03	2.37E-01
himmelbj-3	0.001	1	60	9	7.88E-04	2.53E-01
himmelbj-4	0.001	3	68	34	3.33E-03	9.95E-02
himmelbj-5	0.001	2	61	9	4.91E-03	2.16E-01
himmelbj-ave	0.001	1.8	65.8	13.6	2.30E-03	2.08E-01
himmelbj-1	0.01	1	70	8	1.24E-03	2.39E-01
himmelbj-2	0.01	2	70	8	1.47E-03	2.41E-01
himmelbj-3	0.01	1	55	27	6.93E-04	5.38E-01
himmelbj-4	0.01	3	62	35	9.99E-03	1.82E-01
himmelbj-5	0.01	2	44	55	9.29E-04	3.49E-01
himmelbj-ave	0.01	1.8	60.2	26.6	2.86E-03	3.10E-01

TABLE 2. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hong-1	0.0001	1	24	40	5.36E-06	3.91E-01
hong-2	0.0001	1	22	40	2.21E-05	2.44E-01
hong-3	0.0001	1	24	40	1.10E-05	3.91E-01
hong-4	0.0001	1	24	40	6.85E-06	3.91E-01
hong-5	0.0001	1	22	40	1.62E-05	3.91E-01
hong-ave	0.0001	1.0	23.2	40.0	1.23E-05	3.62E-01
hong-1	0.001	1	23	41	5.49E-05	3.92E-01
hong-2	0.001	1	20	40	2.22E-04	2.44E-01
hong-3	0.001	1	21	41	1.11E-04	3.93E-01
hong-4	0.001	1	23	41	6.99E-05	3.92E-01
hong-5	0.001	1	21	40	1.63E-04	3.93E-01
hong-ave	0.001	1.0	21.6	40.6	1.24E-04	3.63E-01
hong-1	0.01	1	21	39	5.51E-04	3.98E-01
hong-2	0.01	1	19	38	2.22E-03	2.50E-01
hong-3	0.01	1	19	39	1.11E-03	4.06E-01
hong-4	0.01	1	20	39	7.00E-04	4.00E-01
hong-5	0.01	1	19	39	1.64E-03	4.13E-01
hong-ave	0.01	1.0	19.6	38.8	1.25E-03	3.73E-01
hs009-1	0.0001	1	5	2	9.14E-08	1.07E+00
hs009-2	0.0001	1	5	2	9.13E-08	1.07E+00
hs009-3	0.0001	1	5	2	9.14E-08	1.07E+00
hs009-4	0.0001	1	5	2	9.14E-08	1.07E+00
hs009-5	0.0001	1	5	2	9.14E-08	1.07E+00
hs009-ave	0.0001	1.0	5.0	2.0	9.14E-08	1.07E+00
hs009-1	0.001	1	5	2	9.11E-08	1.07E+00
hs009-2	0.001	1	5	4	9.14E-08	1.07E+00
hs009-3	0.001	1	5	3	9.13E-08	1.07E+00
hs009-4	0.001	1	5	3	9.14E-08	1.07E+00
hs009-5	0.001	1	5	3	9.12E-08	1.07E+00
hs009-ave	0.001	1.0	5.0	3.0	9.13E-08	1.07E+00
hs009-1	0.01	1	5	4	9.14E-08	1.07E+00
hs009-2	0.01	1	5	5	9.14E-08	1.07E+00
hs009-3	0.01	1	5	4	9.14E-08	1.07E+00
hs009-4	0.01	1	5	4	9.14E-08	1.07E+00
hs009-5	0.01	1	5	5	9.14E-08	1.07E+00
hs009-ave	0.01	1.0	5.0	4.4	9.14E-08	1.07E+00
hs024-1	0.0001	1	12	4	5.18E-05	7.60E-03
hs024-2	0.0001	1	12	4	6.46E-06	2.69E-03
hs024-3	0.0001	1	12	4	6.73E-06	2.74E-03
hs024-4	0.0001	1	12	4	8.69E-06	3.11E-03
hs024-5	0.0001	1	12	4	7.57E-05	9.19E-03
hs024-ave	0.0001	1.0	12.0	4.0	2.99E-05	5.07E-03
hs024-1	0.001	1	12	6	5.18E-04	2.40E-02
hs024-2	0.001	1	12	4	6.47E-05	8.50E-03
hs024-3	0.001	1	12	5	6.73E-05	8.67E-03
hs024-4	0.001	1	12	5	8.69E-05	9.85E-03
hs024-5	0.001	1	12	4	7.57E-04	2.91E-02
hs024-ave	0.001	1.0	12.0	4.8	2.99E-04	1.60E-02
hs024-1	0.01	1	12	7	5.18E-03	7.64E-02
hs024-2	0.01	1	12	4	6.47E-04	2.69E-02
hs024-3	0.01	1	12	6	6.73E-04	2.74E-02
hs024-4	0.01	1	12	6	8.68E-04	3.11E-02
hs024-5	0.01	1	12	4	7.57E-03	9.27E-02
hs024-ave	0.01	1.0	12.0	5.4	2.99E-03	5.09E-02

TABLE 3. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs036-1	0.0001	1	13	4	1.40E-05	1.79E-04
hs036-2	0.0001	1	13	4	5.66E-05	3.61E-04
hs036-3	0.0001	1	13	4	2.83E-05	2.55E-04
hs036-4	0.0001	1	13	4	1.78E-05	2.02E-04
hs036-5	0.0001	1	13	4	4.16E-05	3.09E-04
hs036-ave	0.0001	1.0	13.0	4.0	3.17E-05	2.61E-04
hs036-1	0.001	1	13	4	1.40E-04	5.67E-04
hs036-2	0.001	1	13	5	5.66E-04	1.14E-03
hs036-3	0.001	1	15	4	2.83E-04	8.07E-04
hs036-4	0.001	1	13	4	1.78E-04	6.40E-04
hs036-5	0.001	1	15	4	4.16E-04	9.78E-04
hs036-ave	0.001	1.0	13.8	4.2	3.17E-04	8.26E-04
hs036-1	0.01	1	14	4	1.40E-03	1.79E-03
hs036-2	0.01	1	16	9	5.66E-03	3.61E-03
hs036-3	0.01	1	15	4	2.84E-03	2.55E-03
hs036-4	0.01	1	15	4	1.78E-03	2.02E-03
hs036-5	0.01	1	15	4	4.16E-03	3.09E-03
hs036-ave	0.01	1.0	15.0	5.0	3.17E-03	2.61E-03
hs037-1	0.0001	1	10	3	1.06E-05	1.26E-04
hs037-2	0.0001	1	10	3	4.30E-05	2.65E-04
hs037-3	0.0001	1	10	3	2.16E-05	1.82E-04
hs037-4	0.0001	1	10	3	1.35E-05	1.43E-04
hs037-5	0.0001	1	10	3	3.16E-05	2.23E-04
hs037-ave	0.0001	1.0	10.0	3.0	2.41E-05	1.88E-04
hs037-1	0.001	1	10	3	1.06E-04	4.49E-04
hs037-2	0.001	1	10	4	4.30E-04	1.18E-03
hs037-3	0.001	1	10	3	2.16E-04	7.13E-04
hs037-4	0.001	1	10	3	1.35E-04	5.23E-04
hs037-5	0.001	1	10	3	3.16E-04	9.38E-04
hs037-ave	0.001	1.0	10.0	3.2	2.41E-04	7.61E-04
hs037-1	0.01	1	10	4	1.07E-03	2.52E-03
hs037-2	0.01	1	10	9	4.30E-03	9.16E-03
hs037-3	0.01	1	10	4	2.16E-03	4.77E-03
hs037-4	0.01	1	10	4	1.35E-03	3.12E-03
hs037-5	0.01	1	10	4	3.16E-03	6.85E-03
hs037-ave	0.01	1.0	10.0	5.0	2.41E-03	5.28E-03
hs041-1	0.0001	1	8	5	2.36E-06	2.46E-03
hs041-2	0.0001	1	8	5	5.11E-06	3.62E-03
hs041-3	0.0001	1	8	5	3.71E-06	3.08E-03
hs041-4	0.0001	1	8	5	2.71E-06	2.63E-03
hs041-5	0.0001	1	8	5	5.07E-06	3.60E-03
hs041-ave	0.0001	1.0	8.0	5.0	3.79E-06	3.08E-03
hs041-1	0.001	1	8	5	1.50E-05	6.19E-03
hs041-2	0.001	1	8	5	5.67E-05	1.20E-02
hs041-3	0.001	1	8	5	2.96E-05	8.70E-03
hs041-4	0.001	1	8	5	1.89E-05	6.95E-03
hs041-5	0.001	1	8	5	4.30E-05	1.05E-02
hs041-ave	0.001	1.0	8.0	5.0	3.26E-05	8.88E-03
hs041-1	0.01	1	8	5	1.43E-04	1.91E-02
hs041-2	0.01	1	8	5	5.74E-04	3.83E-02
hs041-3	0.01	1	8	5	2.89E-04	2.72E-02
hs041-4	0.01	1	8	5	1.82E-04	2.16E-02
hs041-5	0.01	1	8	5	4.23E-04	3.29E-02
hs041-ave	0.01	1.0	8.0	5.0	3.22E-04	2.78E-02

TABLE 4. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs049-1	0.0001	1	16	2	4.45E-03	1.20E-01
hs049-2	0.0001	1	16	1	2.66E-03	9.30E-02
hs049-3	0.0001	1	16	2	4.42E-03	1.20E-01
hs049-4	0.0001	1	16	2	4.40E-03	1.20E-01
hs049-5	0.0001	1	16	2	4.44E-03	1.20E-01
hs049-ave	0.0001	1.0	16.0	1.8	4.08E-03	1.15E-01
hs049-1	0.001	1	16	3	5.59E-03	1.35E-01
hs049-2	0.001	1	16	2	4.44E-03	1.20E-01
hs049-3	0.001	1	16	3	5.21E-03	1.30E-01
hs049-4	0.001	1	16	3	5.07E-03	1.28E-01
hs049-5	0.001	1	16	3	5.54E-03	1.34E-01
hs049-ave	0.001	1.0	16.0	2.8	5.17E-03	1.30E-01
hs049-1	0.01	1	16	4	6.28E-03	1.43E-01
hs049-2	0.01	1	16	3	5.57E-03	1.34E-01
hs049-3	0.01	1	16	4	2.26E-03	8.58E-02
hs049-4	0.01	1	16	4	1.99E-03	8.04E-02
hs049-5	0.01	1	16	4	6.79E-03	1.48E-01
hs049-ave	0.01	1.0	16.0	3.8	4.58E-03	1.18E-01
hs050-1	0.0001	1	14	2	4.59E-05	1.22E-02
hs050-2	0.0001	1	14	1	6.62E-06	4.63E-03
hs050-3	0.0001	1	14	1	1.34E-05	6.58E-03
hs050-4	0.0001	1	14	1	8.72E-06	5.31E-03
hs050-5	0.0001	1	14	1	2.03E-05	8.11E-03
hs050-ave	0.0001	1.0	14.0	1.2	1.90E-05	7.36E-03
hs050-1	0.001	1	14	3	4.60E-04	3.87E-02
hs050-2	0.001	1	14	2	6.96E-05	1.50E-02
hs050-3	0.001	1	14	2	1.41E-04	2.14E-02
hs050-4	0.001	1	14	2	9.15E-05	1.72E-02
hs050-5	0.001	1	14	2	2.14E-04	2.63E-02
hs050-ave	0.001	1.0	14.0	2.2	1.95E-04	2.37E-02
hs050-1	0.01	1	14	4	4.60E-03	1.25E-01
hs050-2	0.01	1	14	3	6.97E-04	4.76E-02
hs050-3	0.01	1	14	3	1.41E-03	6.78E-02
hs050-4	0.01	1	14	3	9.17E-04	5.45E-02
hs050-5	0.01	1	14	4	2.14E-03	8.35E-02
hs050-ave	0.01	1.0	14.0	3.4	1.95E-03	7.57E-02
hs054-1	0.0001	1	10	1	3.03E-06	1.11E-03
hs054-2	0.0001	1	10	1	1.22E-05	2.23E-03
hs054-3	0.0001	1	10	1	6.13E-06	1.58E-03
hs054-4	0.0001	1	10	1	3.85E-06	1.25E-03
hs054-5	0.0001	1	10	1	8.98E-06	1.91E-03
hs054-ave	0.0001	1.0	10.0	1.0	6.84E-06	1.62E-03
hs054-1	0.001	1	10	2	3.18E-05	3.60E-03
hs054-2	0.001	1	10	2	1.28E-04	7.24E-03
hs054-3	0.001	1	10	2	6.43E-05	5.12E-03
hs054-4	0.001	1	10	2	4.04E-05	4.06E-03
hs054-5	0.001	1	10	2	9.43E-05	6.20E-03
hs054-ave	0.001	1.0	10.0	2.0	7.18E-05	5.24E-03
hs054-1	0.01	1	10	3	3.18E-04	1.14E-02
hs054-2	0.01	1	10	3	1.29E-03	2.30E-02
hs054-3	0.01	1	10	3	6.44E-04	1.62E-02
hs054-4	0.01	1	10	3	4.05E-04	1.29E-02
hs054-5	0.01	1	10	3	9.45E-04	1.97E-02
hs054-ave	0.01	1.0	10.0	3.0	7.20E-04	1.66E-02

TABLE 5. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs062-1	0.0001	1	12	15	5.15E-06	1.16E-05
hs062-2	0.0001	1	12	15	2.08E-05	4.68E-05
hs062-3	0.0001	1	12	15	1.04E-05	2.34E-05
hs062-4	0.0001	1	12	15	6.55E-06	1.47E-05
hs062-5	0.0001	1	12	15	1.53E-05	3.44E-05
hs062-ave	0.0001	1.0	12.0	15.0	1.16E-05	2.62E-05
hs062-1	0.001	1	12	15	5.15E-05	1.16E-04
hs062-2	0.001	1	12	15	2.08E-04	4.68E-04
hs062-3	0.001	1	12	15	1.04E-04	2.34E-04
hs062-4	0.001	1	12	15	6.54E-05	1.47E-04
hs062-5	0.001	1	12	15	1.53E-04	3.44E-04
hs062-ave	0.001	1.0	12.0	15.0	1.16E-04	2.62E-04
hs062-1	0.01	1	12	15	5.15E-04	1.16E-03
hs062-2	0.01	1	12	15	2.08E-03	4.70E-03
hs062-3	0.01	1	12	15	1.04E-03	2.34E-03
hs062-4	0.01	1	12	15	6.54E-04	1.47E-03
hs062-5	0.01	1	12	15	1.53E-03	3.43E-03
hs062-ave	0.01	1.0	12.0	15.0	1.16E-03	2.62E-03
hs086-1	0.0001	1	13	7	5.47E-06	2.18E-04
hs086-2	0.0001	1	13	7	4.37E-06	1.95E-04
hs086-3	0.0001	1	13	7	1.44E-05	3.55E-04
hs086-4	0.0001	1	13	7	1.01E-05	2.96E-04
hs086-5	0.0001	1	13	7	7.32E-06	2.52E-04
hs086-ave	0.0001	1.0	13.0	7.0	8.32E-06	2.63E-04
hs086-1	0.001	1	13	7	4.64E-05	6.36E-04
hs086-2	0.001	1	13	7	3.85E-05	5.85E-04
hs086-3	0.001	1	13	7	1.40E-04	1.14E-03
hs086-4	0.001	1	13	7	9.32E-05	9.02E-04
hs086-5	0.001	1	13	7	7.92E-05	8.31E-04
hs086-ave	0.001	1.0	13.0	7.0	7.95E-05	8.19E-04
hs086-1	0.01	1	13	7	4.57E-04	2.02E-03
hs086-2	0.01	1	13	7	3.82E-04	2.00E-03
hs086-3	0.01	1	13	7	1.40E-03	4.60E-03
hs086-4	0.01	1	13	7	9.25E-04	2.90E-03
hs086-5	0.01	1	13	8	7.97E-04	2.68E-03
hs086-ave	0.01	1.0	13.0	7.2	7.92E-04	2.84E-03
hs112-1	0.0001	1	15	11	1.58E-05	2.38E-04
hs112-2	0.0001	1	15	11	4.60E-06	1.28E-04
hs112-3	0.0001	1	15	11	7.56E-06	1.65E-04
hs112-4	0.0001	1	15	11	5.99E-06	1.47E-04
hs112-5	0.0001	1	15	11	1.29E-05	2.15E-04
hs112-ave	0.0001	1.0	15.0	11.0	9.37E-06	1.79E-04
hs112-1	0.001	1	15	11	1.59E-04	7.54E-04
hs112-2	0.001	1	15	11	3.16E-05	3.37E-04
hs112-3	0.001	1	15	11	6.26E-05	4.75E-04
hs112-4	0.001	1	15	11	5.35E-05	4.38E-04
hs112-5	0.001	1	15	11	1.25E-04	6.69E-04
hs112-ave	0.001	1.0	15.0	11.0	8.62E-05	5.35E-04
hs112-1	0.01	1	15	8	1.58E-03	2.39E-03
hs112-2	0.01	1	15	11	3.04E-04	1.05E-03
hs112-3	0.01	1	15	11	6.14E-04	1.51E-03
hs112-4	0.01	1	15	10	5.31E-04	1.39E-03
hs112-5	0.01	1	15	8	1.24E-03	2.15E-03
hs112-ave	0.01	1.0	15.0	9.6	8.55E-04	1.70E-03

TABLE 6. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.

Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs119-1	0.0001	1	21	21	4.45E-05	1.93E-04
hs119-2	0.0001	1	21	21	1.65E-05	8.25E-05
hs119-3	0.0001	1	21	21	5.56E-06	3.94E-05
hs119-4	0.0001	1	21	21	2.20E-05	8.61E-05
hs119-5	0.0001	2	21	21	7.64E-06	5.15E-05
hs119-ave	0.0001	1.2	21.0	21.0	1.92E-05	9.06E-05
hs119-1	0.001	1	21	21	4.45E-04	1.62E-03
hs119-2	0.001	1	21	21	1.65E-04	5.20E-04
hs119-3	0.001	1	21	21	5.56E-05	1.30E-04
hs119-4	0.001	1	21	21	2.20E-04	4.41E-04
hs119-5	0.001	2	21	21	7.64E-05	2.75E-04
hs119-ave	0.001	1.2	21.0	21.0	1.92E-04	5.97E-04
hs119-1	0.01	1	20	21	4.45E-03	1.59E-02
hs119-2	0.01	1	20	21	1.65E-03	4.79E-03
hs119-3	0.01	1	20	21	5.56E-04	5.61E-04
hs119-4	0.01	1	21	21	2.20E-03	3.73E-03
hs119-5	0.01	2	21	21	7.64E-04	2.37E-03
hs119-ave	0.01	1.2	20.4	21.0	1.92E-03	5.46E-03
hubfit-1	0.0001	1	9	4	8.72E-06	3.41E-03
hubfit-2	0.0001	1	9	4	3.61E-05	6.94E-03
hubfit-3	0.0001	1	9	4	1.79E-05	4.88E-03
hubfit-4	0.0001	1	9	4	1.11E-05	3.86E-03
hubfit-5	0.0001	1	9	4	2.63E-05	5.92E-03
hubfit-ave	0.0001	1.0	9.0	4.0	2.00E-05	5.00E-03
hubfit-1	0.001	1	9	4	8.91E-05	1.09E-02
hubfit-2	0.001	1	9	6	3.61E-04	2.19E-02
hubfit-3	0.001	1	9	4	1.81E-04	1.55E-02
hubfit-4	0.001	1	9	4	1.13E-04	1.23E-02
hubfit-5	0.001	1	9	4	2.65E-04	1.88E-02
hubfit-ave	0.001	1.0	9.0	4.4	2.02E-04	1.59E-02
hubfit-1	0.01	1	9	4	8.93E-04	3.45E-02
hubfit-2	0.01	1	9	8	3.61E-03	6.94E-02
hubfit-3	0.01	1	9	4	1.81E-03	4.91E-02
hubfit-4	0.01	1	9	4	1.14E-03	3.89E-02
hubfit-5	0.01	1	9	4	2.65E-03	5.95E-02
hubfit-ave	0.01	1.0	9.0	4.8	2.02E-03	5.03E-02
lin-1	0.0001	1	6	2	1.57E-05	4.54E-03
lin-2	0.0001	1	6	2	1.80E-06	1.54E-03
lin-3	0.0001	1	6	2	6.61E-06	2.94E-03
lin-4	0.0001	1	6	2	8.59E-06	3.36E-03
lin-5	0.0001	1	6	2	2.31E-05	5.50E-03
lin-ave	0.0001	1.0	6.0	2.0	1.12E-05	3.58E-03
lin-1	0.001	1	6	3	1.57E-04	1.43E-02
lin-2	0.001	1	6	2	1.97E-05	5.08E-03
lin-3	0.001	1	6	3	7.07E-05	9.62E-03
lin-4	0.001	1	6	3	9.12E-05	1.09E-02
lin-5	0.001	1	7	3	2.29E-04	1.73E-02
lin-ave	0.001	1.0	6.2	2.8	1.14E-04	1.15E-02
lin-1	0.01	1	6	4	1.57E-03	4.54E-02
lin-2	0.01	1	7	3	1.96E-04	1.60E-02
lin-3	0.01	1	6	4	7.08E-04	3.05E-02
lin-4	0.01	1	6	4	9.14E-04	3.46E-02
lin-5	0.01	1	7	4	2.30E-03	5.49E-02
lin-ave	0.01	1.0	6.4	3.8	1.14E-03	3.63E-02

TABLE 7. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint right-hand sides, b, have been modified. All problems considered have linear constraints. Each problem is labeled under the column Problem, 5 instances of each problem are presented, "ave" refers to the average performance over the five problems, δ is the perturbation parameter, and #Pert is the number of perturbed coefficients. The iteration counts for the warmstart and coldstart solution of five perturbed problems are given, and the last 2 columns are the scaled Euclidean norm of the distance between the optimal solutions and the Lagrange multipliers of the initial and the perturbed problem.