Problem	δ	#Pert	ColdIters	WarmIters	$\|x^I - x^P\|$	$\|y^I - y^P\|$
dtoc1l-1	0.0001	20	6	3	9.25E-07	3.67E-04
dtoc1l-2	0.0001	20	6	2	9.20E-07	3.67E-04
dtoc1l-3	0.0001	22	6	3	9.37E-07	3.70E-04
dtoc1l-4	0.0001	16	6	3	9.37E-07	3.70E-04
dtoc1l-5	0.0001	26	6	3	9.47E-07	3.72E-04
dtoc1l-ave	0.0001	20.8	6.0	2.8	9.33E-07	3.69E-04
dtoc1l-1	0.001	20	6	4	1.64E-06	4.90E-04
dtoc1l-2	0.001	20	6	3	1.27E-06	4.30E-04
dtoc1l-3	0.001	22	6	3	2.28E-06	5.77E-04
dtoc1l-4	0.001	16	6	3	2.25E-06	5.74E-04
dtoc1l-5	0.001	26	6	3	2.70E-06	6.27E-04
dtoc1l-ave	0.001	20.8	6.0	3.2	2.03E-06	5.39E-04
dtoc1l-1	0.01	20	6	4	1.36E-05	1.42E-03
dtoc1l-2	0.01	20	6	4	8.87E-06	1.14E-03
dtoc1l-3	0.01	22	6	4	2.09E-05	1.75E-03
dtoc1l-4	0.01	16	6	4	2.06E-05	1.74E-03
dtoc1l-5	0.01	26	6	4	2.54E-05	1.93E-03
dtoc1l-ave	0.01	20.8	6.0	4.0	1.79E-05	1.59E-03
expfita-1	0.0001	6	19	13	7.12E-06	1.07E-02
expfita-2	0.0001	8	19	13	5.45E-06	9.33E-03
expfita-3	0.0001	2	19	13	7.33E-06	1.08E-02
expfita-4	0.0001	11	18	13	1.15E-05	1.35E-02
expfita-5	0.0001	8	19	13	1.87E-05	1.73E-02
expfita-ave	0.0001	7.0	18.8	13.0	1.00E-05	1.23E-02
expfita-1	0.001	6	19	13	1.43E-06	4.78E-03
expfita-2	0.001	8	19	13	5.41E-05	2.94E-02
expfita-3	0.001	2	19	13	7.79E-06	1.11E-02
expfita-4	0.001	11	18	13	4.83E-05	2.78E-02
expfita-5	0.001	8	19	13	1.35E-04	4.65E-02
expfita-ave	0.001	7.0	18.8	13.0	4.94E-05	2.39E-02
expfita-1	0.01	6	19	13	1.66E-05	1.63E-02
expfita-2	0.01	8	19	14	5.61E-04	9.47E-02
expfita-3	0.01	2	19	13	5.08E-06	9.01E-03
expfita-4	0.01	11	18	15	4.56E-04	8.53E-02
expfita-5	0.01	8	18	14	1.21E-03	1.39E-01
expfita-ave	0.01	7.0	18.6	13.8	4.50E-04	6.89E-02
expfitb-1	0.0001	19	23	19	5.24E-06	8.93E-03
expfitb-2	0.0001	26	23	19	9.27E-05	3.76E-02
expfitb-3	0.0001	16	22	19	3.64E-06	7.45E-03
expfitb-4	0.0001	17	23	19	1.59E-06	4.91E-03
expfitb-5	0.0001	23	23	19	5.99E-06	9.55E-03
expfitb-ave	0.0001	20.2	22.8	19.0	2.18E-05	1.37E-02
expfitb-1	0.001	19	22	19	5.88E-05	2.99E-02
expfitb-2	0.001	26	23	19	6.75E-05	3.21E-02
expfitb-3	0.001	16	28	19	1.45E-04	4.69E-02
expfitb-4	0.001	17	23	19	1.00E-04	3.91E-02
expfitb-5	0.001	23	26	19	1.70E-04	5.09E-02
expfitb-ave	0.001	20.2	24.4	19.0	1.08E-04	3.98E-02
expfitb-1	0.01	19	22	19	7.10E-04	1.04E-01
expfitb-2	0.01	26	23	29	7.14E-04	1.04E-01
expfitb-3	0.01	16	23	24	1.67E-03	1.59E-01
expfitb-4	0.01	17	24	20	1.26E-03	1.39E-01
expfitb-5	0.01	23	22	19	1.93E-03	1.71E-01
expfitb-ave	0.01	20.2	22.8	22.2	1.26E-03	1.36E-01

TABLE 1. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	38	31	29	3.28E-05	2.11E-02
expfitc-2	0.0001	18	36	29	1.10E-04	3.85E-02
expfitc-3	0.0001	22	31	29	1.06E-04	3.77E-02
expfitc-4	0.0001	21	31	31	6.88E-05	3.05E-02
expfitc-5	0.0001	18	32	32	8.86E-05	3.45E-02
expfitc-ave	0.0001	23.4	32.2	30.0	8.12E-05	3.24E-02
expfitc-1	0.001	38	32	26	1.08E-04	3.82E-02
expfitc-2	0.001	18	30	26	4.22E-05	2.38E-02
expfitc-3	0.001	22	36	32	2.49E-04	5.77E-02
expfitc-4	0.001	21	26	32	2.31E-05	1.77E-02
expfitc-5	0.001	18	31	33	2.40E-05	1.80E-02
expfitc-ave	0.001	23.4	31.0	29.8	8.92E-05	3.11E-02
expfitc-1	0.01	38	30	40	3.91E-04	7.46E-02
expfitc-2	0.01	18	30	30	2.20E-04	5.43E-02
expfitc-3	0.01	22	37	39	1.64E-03	1.50E-01
expfitc-4	0.01	21	34	29	5.01E-04	8.22E-02
expfitc-5	0.01	18	31	39	9.97E-05	3.67E-02
expfitc-ave	0.01	23.4	32.4	35.4	5.71E-04	7.95E-02
himmelbi-1	0.0001	12	22	8	3.63E-01	9.05E+01
himmelbi-2	0.0001	15	22	1	3.12E-01	8.30E+01
himmelbi-3	0.0001	15	22	25	7.90E-03	1.32E+01
himmelbi-4	0.0001	6	22	1	3.12E-01	8.30E+01
himmelbi-5	0.0001	9	22	3	3.78E-01	9.14E+01
himmelbi-ave	0.0001	11.4	22.0	7.6	2.75E-01	7.22E+01
himmelbi-1	0.001	12	22	9	3.45E-01	8.71E+01
himmelbi-2	0.001	15	22	6	4.24E-01	9.68E+01
himmelbi-3	0.001	15	22	4	3.27E-01	8.48E+01
himmelbi-4	0.001	6	22	14	3.36E-01	8.60E+01
himmelbi-5	0.001	9	22	8	3.36E-01	8.64E+01
himmelbi-ave	0.001	11.4	22.0	8.2	3.53E-01	8.82E+01
himmelbi-1	0.01	12	22	14	4.03E-01	9.43E+01
himmelbi-2	0.01	15	22	1	3.12E-01	8.30E+01
himmelbi-3	0.01	15	22	29	7.87E-03	1.32E+01
himmelbi-4	0.01	6	22	1	3.12E-01	8.30E+01
himmelbi-5	0.01	9	22	11	3.34E-01	8.58E+01
himmelbi-ave	0.01	11.4	22.0	11.2	2.74E-01	7.18E+01
himmelbj-1	0.0001	8	70	8	1.22E-03	2.36E-01
himmelbj-2	0.0001	10	70	8	2.98E-03	2.40E-01
himmelbj-3	0.0001	10	70	8	1.91E-03	2.38E-01
himmelbj-4	0.0001	10	70	9	2.16E-02	2.41E-01
himmelbj-5	0.0001	9	70	9	1.10E-02	2.52E-01
himmelbj-ave	0.0001	9.4	70.0	8.4	7.74E-03	2.41E-01
himmelbj-1	0.001	8	70	9	9.76E-04	2.37E-01
himmelbj-2	0.001	10	70	10	2.05E-02	2.72E-01
himmelbj-3	0.001	10	70	9	8.07E-03	2.52E-01
himmelbj-4	0.001	10	70	15	8.78E-02	3.22E-01
himmelbj-5	0.001	9	70	17	2.05E-01	5.20E-01
himmelbj-ave	0.001	9.4	70.0	12.0	6.45E-02	3.21E-01
himmelbj-1	0.01	8	70	8	1.20E-03	2.28E-01
himmelbj-2	0.01	10	70	25	5.51E-01	7.84E-01
himmelbj-3	0.01	10	70	17	1.17E-01	4.16E-01
himmelbj-4	0.01	10	70	28	1.16E-01	6.48E-01
himmelbj-5	0.01	9	70	61	1.22E+00	1.57E+00
himmelbj-ave	0.01	9.4	70.0	27.8	4.02E-01	7.30E-01

TABLE 2. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	18	37	2.09E-07	6.42E-02
hong-2	0.0001	1	18	37	2.09E-07	6.42E-02
hong-3	0.0001	1	18	37	2.09E-07	6.42E-02
hong-4	0.0001	1	18	37	2.08E-07	6.41E-02
hong-5	0.0001	1	18	37	2.09E-07	6.41E-02
hong-ave	0.0001	1.0	18.0	37.0	2.09E-07	6.41E-02
hong-1	0.001	1	18	37	2.09E-07	6.42E-02
hong-2	0.001	1	18	37	2.09E-07	6.43E-02
hong-3	0.001	1	18	37	2.09E-07	6.42E-02
hong-4	0.001	1	18	37	2.08E-07	6.39E-02
hong-5	0.001	1	18	37	2.09E-07	6.41E-02
hong-ave	0.001	1.0	18.0	37.0	2.08E-07	6.41E-02
hong-1	0.01	1	18	37	2.09E-07	6.45E-02
hong-2	0.01	1	17	37	2.11E-07	6.40E-02
hong-3	0.01	1	18	37	2.09E-07	6.45E-02
hong-4	0.01	1	18	39	1.76E-07	2.65E-01
hong-5	0.01	1	18	37	2.08E-07	6.41E-02
hong-ave	0.01	1.0	17.8	37.4	2.03E-07	1.04E-01
hs009-1	0.0001	1	12	14	9.14E-08	1.07E+00
hs009-2	0.0001	1	9	10	9.14E-08	1.07E+00
hs009-3	0.0001	1	10	11	9.14E-08	1.07E+00
hs009-4	0.0001	1	12	11	9.14E-08	1.07E+00
hs009-5	0.0001	1	12	13	9.14E-08	1.07E+00
hs009-ave	0.0001	1.0	11.0	11.8	9.14E-08	1.07E+00
hs009-1	0.001	1	25	13	9.13E-08	1.07E+00
hs009-2	0.001	1	16	13	9.14E-08	1.07E+00
hs009-3	0.001	1	14	13	9.13E-08	1.07E+00
hs009-4	0.001	1	23	13	9.13E-08	1.07E+00
hs009-5	0.001	1	13	16	9.15E-08	1.07E+00
hs009-ave	0.001	1.0	18.2	13.6	9.14E-08	1.07E+00
hs009-1	0.01	1	42	19	9.06E-08	1.06E+00
hs009-2	0.01	1	23	14	9.15E-08	1.07E+00
hs009-3	0.01	1	19	17	9.10E-08	1.06E+00
hs009-4	0.01	1	19	18	9.09E-08	1.06E+00
hs009-5	0.01	1	15	18	9.25E-08	1.07E+00
hs009-ave	0.01	1.0	23.6	17.2	9.13E-08	1.07E+00
hs024-1	0.0001	1	12	4	5.36E-09	7.74E-05
hs024-2	0.0001	1	12	4	3.69E-09	6.63E-05
hs024-3	0.0001	1	12	4	1.49E-09	4.09E-05
hs024-4	0.0001	1	12	4	2.03E-09	4.77E-05
hs024-5	0.0001	1	12	4	8.37E-09	9.70E-05
hs024-ave	0.0001	1.0	12.0	4.0	4.19E-09	6.58E-05
hs024-1	0.001	1	12	5	3.20E-10	3.34E-05
hs024-2	0.001	1	12	4	3.04E-08	2.48E-04
hs024-3	0.001	1	12	4	1.21E-08	1.21E-04
hs024-4	0.001	1	12	4	5.49E-09	8.10E-05
hs024-5	0.001	1	12	5	7.35E-09	1.22E-04
hs024-ave	0.001	1.0	12.0	4.4	1.11E-08	1.21E-04
hs024-1	0.01	1	12	6	4.46E-10	2.76E-04
hs024-2	0.01	1	12	5	1.68E-08	1.68E-03
hs024-3	0.01	1	12	6	1.64E-09	3.59E-04
hs024-4	0.01	1	12	6	4.43E-10	2.09E-04
hs024-5	0.01	1	12	6	4.00E-09	8.19E-04
hs024-ave	0.01	1.0	12.0	5.8	4.66E-09	6.68E-04

TABLE 3. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	2.58E-08	7.70E-06
hs036-2	0.0001	1	13	4	2.69E-08	1.34E-05
hs036-3	0.0001	1	13	4	2.59E-08	2.34E-05
hs036-4	0.0001	1	13	4	2.78E-08	8.00E-06
hs036-5	0.0001	1	13	4	2.80E-08	8.02E-06
hs036-ave	0.0001	1.0	13.0	4.0	2.69E-08	1.21E-05
hs036-1	0.001	1	14	4	2.30E-08	7.27E-06
hs036-2	0.001	1	13	4	1.12E-08	1.09E-04
hs036-3	0.001	1	13	5	2.90E-08	2.21E-04
hs036-4	0.001	1	13	4	2.89E-08	8.15E-06
hs036-5	0.001	1	13	4	3.02E-08	8.32E-06
hs036-ave	0.001	1.0	13.2	4.2	2.45E-08	7.08E-05
hs036-1	0.01	1	15	5	2.65E-08	7.80E-06
hs036-2	0.01	1	13	7	2.67E-08	1.09E-03
hs036-3	0.01	1	13	8	2.51E-08	2.20E-03
hs036-4	0.01	1	13	5	2.96E-08	8.24E-06
hs036-5	0.01	1	13	6	2.36E-08	7.37E-06
hs036-ave	0.01	1.0	13.4	6.2	2.63E-08	6.64E-04
hs037-1	0.0001	1	10	3	2.46E-05	1.90E-04
hs037-2	0.0001	1	10	3	4.33E-06	7.92E-05
hs037-3	0.0001	1	10	3	8.78E-06	1.13E-04
hs037-4	0.0001	1	10	3	7.84E-06	1.07E-04
hs037-5	0.0001	1	10	3	1.83E-05	1.63E-04
hs037-ave	0.0001	1.0	10.0	3.0	1.28E-05	1.30E-04
hs037-1	0.001	1	10	4	2.46E-04	6.31E-04
hs037-2	0.001	1	10	4	4.35E-05	2.53E-04
hs037-3	0.001	1	10	4	8.80E-05	3.64E-04
hs037-4	0.001	1	10	4	7.82E-05	3.39E-04
hs037-5	0.001	1	10	4	1.83E-04	5.25E-04
hs037-ave	0.001	1.0	10.0	4.0	1.28E-04	4.23E-04
hs037-1	0.01	1	10	5	2.47E-03	2.80E-03
hs037-2	0.01	1	10	6	4.34E-04	8.72E-04
hs037-3	0.01	1	10	8	8.79E-04	1.35E-03
hs037-4	0.01	1	10	6	7.81E-04	1.16E-03
hs037-5	0.01	1	10	7	1.82E-03	1.95E-03
hs037-ave	0.01	1.0	10.0	6.4	1.28E-03	1.63E-03
hs041-1	0.0001	1	8	5	2.21E-06	2.38E-03
hs041-2	0.0001	1	8	5	6.19E-06	3.98E-03
hs041-3	0.0001	1	8	6	6.98E-07	1.34E-03
hs041-4	0.0001	1	8	5	1.96E-06	2.24E-03
hs041-5	0.0001	1	8	5	4.39E-06	3.35E-03
hs041-ave	0.0001	1.0	8.0	5.2	3.09E-06	2.66E-03
hs041-1	0.001	1	8	5	1.25E-05	5.67E-03
hs041-2	0.001	1	8	5	6.94E-05	1.33E-02
hs041-3	0.001	1	8	5	1.33E-06	1.84E-03
hs041-4	0.001	1	8	5	9.74E-06	4.99E-03
hs041-5	0.001	1	8	5	3.54E-05	9.52E-03
hs041-ave	0.001	1.0	8.0	5.0	2.57E-05	7.07E-03
hs041-1	0.01	1	8	5	1.17E-04	1.73E-02
hs041-2	0.01	1	8	5	7.06E-04	4.25E-02
hs041-3	0.01	1	8	5	1.06E-06	1.65E-03
hs041-4	0.01	1	8	5	8.88E-05	1.51E-02
hs041-5	0.01	1	8	5	3.45E-04	2.97E-02
hs041-ave	0.01	1.0	8.0	5.0	2.52E-04	2.13E-02

TABLE 4. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	1	2.67E-03	9.31E-02
hs049-2	0.0001	1	16	2	4.48E-03	1.21E-01
hs049-3	0.0001	1	16	2	4.48E-03	1.21E-01
hs049-4	0.0001	1	16	2	4.48E-03	1.21E-01
hs049-5	0.0001	1	16	2	4.48E-03	1.21E-01
hs049-ave	0.0001	1.0	16.0	1.8	4.12E-03	1.15E-01
hs049-1	0.001	1	16	2	4.47E-03	1.21E-01
hs049-2	0.001	1	16	2	4.47E-03	1.20E-01
hs049-3	0.001	1	16	3	5.69E-03	1.36E-01
hs049-4	0.001	1	16	2	4.46E-03	1.20E-01
hs049-5	0.001	1	16	2	4.46E-03	1.20E-01
hs049-ave	0.001	1.0	16.0	2.2	4.71E-03	1.24E-01
hs049-1	0.01	1	16	3	5.67E-03	1.36E-01
hs049-2	0.01	1	16	3	5.66E-03	1.36E-01
hs049-3	0.01	1	16	4	6.44E-03	1.45E-01
hs049-4	0.01	1	16	3	5.64E-03	1.35E-01
hs049-5	0.01	1	16	3	5.65E-03	1.35E-01
hs049-ave	0.01	1.0	16.0	3.2	5.81E-03	1.37E-01
hs050-1	0.0001	1	14	2	6.25E-07	1.42E-03
hs050-2	0.0001	1	14	2	1.57E-07	7.13E-04
hs050-3	0.0001	1	14	2	5.74E-07	1.36E-03
hs050-4	0.0001	1	14	2	1.92E-07	7.88E-04
hs050-5	0.0001	1	14	2	8.80E-07	1.69E-03
hs050-ave	0.0001	1.0	14.0	2.0	4.86E-07	1.19E-03
hs050-1	0.001	1	14	3	3.35E-07	1.04E-03
hs050-2	0.001	1	14	3	8.91E-08	5.37E-04
hs050-3	0.001	1	14	3	3.03E-07	9.91E-04
hs050-4	0.001	1	14	3	1.15E-07	6.09E-04
hs050-5	0.001	1	14	3	4.67E-07	1.23E-03
hs050-ave	0.001	1.0	14.0	3.0	2.62E-07	8.82E-04
hs050-1	0.01	1	14	4	1.72E-07	7.45E-04
hs050-2	0.01	1	14	3	8.22E-07	1.63E-03
hs050-3	0.01	1	14	4	1.55E-07	7.09E-04
hs050-4	0.01	1	14	3	9.16E-07	1.72E-03
hs050-5	0.01	1	14	4	2.24E-07	8.51E-04
hs050-ave	0.01	1.0	14.0	3.6	4.58E-07	1.13E-03
hs054-1	0.0001	1	10	3	1.04E-05	2.06E-03
hs054-2	0.0001	1	10	2	1.31E-06	7.30E-04
hs054-3	0.0001	1	10	2	4.64E-06	1.38E-03
hs054-4	0.0001	1	10	3	6.04E-06	1.57E-03
hs054-5	0.0001	1	10	3	1.52E-05	2.49E-03
hs054-ave	0.0001	1.0	10.0	2.6	7.52E-06	1.64E-03
hs054-1	0.001	1	10	3	1.04E-04	6.51E-03
hs054-2	0.001	1	10	3	1.30E-05	2.30E-03
hs054-3	0.001	1	10	3	4.67E-05	4.37E-03
hs054-4	0.001	1	10	3	6.03E-05	4.96E-03
hs054-5	0.001	1	10	4	1.52E-04	7.87E-03
hs054-ave	0.001	1.0	10.0	3.2	7.52E-05	5.20E-03
hs054-1	0.01	1	10	4	1.04E-03	2.06E-02
hs054-2	0.01	1	10	3	1.30E-04	7.27E-03
hs054-3	0.01	1	10	4	4.67E-04	1.38E-02
hs054-4	0.01	1	10	4	6.02E-04	1.57E-02
hs054-5	0.01	1	10	4	1.52E-03	2.49E-02
hs054-ave	0.01	1.0	10.0	3.8	7.51E-04	1.65E-02

TABLE 5. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs055-1	0.0001	1	9	12	9.25E-08	1.31E-01
hs055-2	0.0001	1	9	12	2.66E-08	1.67E-01
hs055-3	0.0001	2	9	12	1.17E-07	1.44E-01
hs055-4	0.0001	1	9	12	4.74E-08	1.36E-01
hs055-5	0.0001	1	9	12	7.82E-08	1.31E-01
hs055-ave	0.0001	1.2	9.0	12.0	7.24E-08	1.42E-01
hs055-1	0.001	1	9	13	5.36E-08	1.90E-01
hs055-2	0.001	1	9	12	2.23E-08	2.97E-01
hs055-3	0.001	2	9	13	4.81E-08	2.19E-01
hs055-4	0.001	1	9	12	2.38E-08	1.73E-01
hs055-5	0.001	1	9	12	1.45E-07	1.68E-01
hs055-ave	0.001	1.2	9.0	12.4	5.85E-08	2.09E-01
hs055-1	0.01	1	9	13	4.99E-08	2.67E-01
hs055-2	0.01	1	9	12	8.93E-08	3.70E-01
hs055-3	0.01	2	9	13	4.02E-08	2.60E-01
hs055-4	0.01	1	9	12	1.58E-08	3.49E-01
hs055-5	0.01	1	9	13	5.32E-08	1.76E-01
hs055-ave	0.01	1.2	9.0	12.6	4.97E-08	2.85E-01
hs062-1	0.0001	1	12	15	2.20E-05	1.32E-05
hs062-2	0.0001	1	12	15	1.28E-07	2.50E-07
hs062-3	0.0001	1	12	16	7.65E-07	5.25E-07
hs062-4	0.0001	1	12	14	5.45E-06	1.07E-05
hs062-5	0.0001	1	12	14	1.28E-05	2.50E-05
hs062-ave	0.0001	1.0	12.0	14.8	8.22E-06	9.95E-06
hs062-1	0.001	1	12	15	2.20E-04	1.32E-04
hs062-2	0.001	1	12	13	3.80E-06	2.52E-06
hs062-3	0.001	1	12	13	7.51E-06	5.10E-06
hs062-4	0.001	1	12	14	5.44E-05	1.07E-04
hs062-5	0.001	1	12	15	1.26E-04	2.50E-04
hs062-ave	0.001	1.0	12.0	14.0	8.24E-05	9.94E-05
hs062-1	0.01	1	12	15	2.23E-03	1.32E-03
hs062-2	0.01	1	12	15	3.81E-05	2.51E-05
hs062-3	0.01	1	12	14	7.70E-05	5.08E-05
hs062-4	0.01	1	12	16	5.42E-04	1.07E-03
hs062-5	0.01	1	12	17	1.27E-03	2.50E-03
hs062-ave	0.01	1.0	12.0	15.4	8.30E-04	9.94E-04
hs086-1	0.0001	2	13	7	1.42E-06	1.11E-04
hs086-2	0.0001	2	13	7	1.33E-06	1.09E-04
hs086-3	0.0001	2	13	7	1.45E-06	1.12E-04
hs086-4	0.0001	1	13	7	1.44E-06	1.19E-04
hs086-5	0.0001	2	13	7	1.44E-06	1.12E-04
hs086-ave	0.0001	1.8	13.0	7.0	1.41E-06	1.13E-04
hs086-1	0.001	2	13	7	1.28E-06	1.08E-04
hs086-2	0.001	2	13	7	1.09E-08	1.69E-04
hs086-3	0.001	2	13	7	1.55E-06	1.16E-04
hs086-4	0.001	1	13	7	1.44E-06	4.35E-04
hs086-5	0.001	2	13	7	1.44E-06	1.47E-04
hs086-ave	0.001	1.8	13.0	7.0	1.14E-06	1.95E-04
hs086-1	0.01	2	13	7	9.09E-07	2.61E-04
hs086-2	0.01	2	13	9	1.51E-06	1.69E-03
hs086-3	0.01	2	13	7	3.76E-06	1.82E-04
hs086-4	0.01	1	13	7	1.51E-06	4.23E-03
hs086-5	0.01	2	13	7	1.45E-06	9.75E-04
hs086-ave	0.01	1.8	13.0	7.4	1.83E-06	1.47E-03

TABLE 6. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	$\|x^I - x^P\|$	$\|y^I - y^P\|$
hs112-1	0.0001	1	15	11	1.54E-05	2.38E-04
hs112-2	0.0001	2	15	11	3.57E-05	3.58E-04
hs112-3	0.0001	1	15	11	3.37E-05	3.48E-04
hs112-4	0.0001	2	15	11	5.02E-05	4.24E-04
hs112-5	0.0001	1	15	11	5.95E-05	4.63E-04
hs112-ave	0.0001	1.4	15.0	11.0	3.89E-05	3.66E-04
hs112-1	0.001	1	15	11	1.43E-04	8.05E-04
hs112-2	0.001	2	15	11	3.67E-04	1.15E-03
hs112-3	0.001	1	15	11	3.53E-04	1.13E-03
hs112-4	0.001	2	15	11	5.18E-04	1.37E-03
hs112-5	0.001	1	15	11	6.10E-04	1.50E-03
hs112-ave	0.001	1.4	15.0	11.0	3.98E-04	1.19E-03
hs112-1	0.01	1	15	8	1.39E-03	4.32E-03
hs112-2	0.01	2	15	11	3.77E-03	3.71E-03
hs112-3	0.01	1	15	8	3.57E-03	3.65E-03
hs112-4	0.01	2	15	8	5.26E-03	4.47E-03
hs112-5	0.01	1	15	11	6.46E-03	5.55E-03
hs112-ave	0.01	1.4	15.0	9.2	4.09E-03	4.34E-03
hs119-1	0.0001	4	21	21	4.58E-06	3.61E-05
hs119-2	0.0001	4	21	21	1.38E-05	6.31E-05
hs119-3	0.0001	6	21	21	1.84E-05	7.27E-05
hs119-4	0.0001	10	21	21	8.19E-06	4.85E-05
hs119-5	0.0001	3	21	21	1.56E-06	2.10E-05
hs119-ave	0.0001	5.4	21.0	21.0	9.29E-06	4.83E-05
hs119-1	0.001	4	21	21	4.60E-05	1.29E-04
hs119-2	0.001	4	21	21	1.38E-04	2.36E-04
hs119-3	0.001	6	21	21	1.84E-04	2.67E-04
hs119-4	0.001	10	21	21	8.17E-05	1.78E-04
hs119-5	0.001	3	21	21	1.52E-05	7.26E-05
hs119-ave	0.001	5.4	21.0	21.0	9.28E-05	1.77E-04
hs119-1	0.01	4	21	21	4.60E-04	7.15E-04
hs119-2	0.01	4	21	21	1.38E-03	1.46E-03
hs119-3	0.01	6	21	21	1.83E-03	1.60E-03
hs119-4	0.01	10	21	21	8.15E-04	1.07E-03
hs119-5	0.01	3	21	21	1.52E-04	3.87E-04
hs119-ave	0.01	5.4	21.0	21.0	9.27E-04	1.05E-03
hubfit-1	0.0001	1	9	4	8.45E-06	3.36E-03
hubfit-2	0.0001	1	9	4	8.90E-07	1.09E-03
hubfit-3	0.0001	1	9	4	3.75E-06	2.24E-03
hubfit-4	0.0001	1	9	4	4.83E-06	2.54E-03
hubfit-5	0.0001	1	9	4	1.21E-05	4.02E-03
hubfit-ave	0.0001	1.0	9.0	4.0	6.01E-06	2.65E-03
hubfit-1	0.001	1	9	4	8.29E-05	1.05E-02
hubfit-2	0.001	1	9	4	1.03E-05	3.71E-03
hubfit-3	0.001	1	9	4	3.73E-05	7.05E-03
hubfit-4	0.001	1	9	4	4.81E-05	8.01E-03
hubfit-5	0.001	1	9	5	1.21E-04	1.27E-02
hubfit-ave	0.001	1.0	9.0	4.2	6.00E-05	8.40E-03
hubfit-1	0.01	1	9	4	8.25E-04	3.32E-02
hubfit-2	0.01	1	9	5	1.03E-04	1.17E-02
hubfit-3	0.01	1	9	6	3.71E-04	2.23E-02
hubfit-4	0.01	1	9	8	4.78E-04	2.53E-02
hubfit-5	0.01	1	9	7	1.22E-03	4.03E-02
hubfit-ave	0.01	1.0	9.0	6.0	5.99E-04	2.66E-02

TABLE 7. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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	$\|x^I - x^P\|$	$\|y^I - y^P\|$
water-1	0.0001	5	23	22	8.51E-03	7.08E+00
water-2	0.0001	5	23	19	1.30E-02	1.67E+00
water-3	0.0001	5	23	21	1.11E-02	3.94E+00
water-4	0.0001	7	23	22	1.18E-01	4.46E+00
water-5	0.0001	4	23	23	2.09E-02	3.97E+00
water-ave	0.0001	5.2	23.0	21.4	3.44E-02	4.22E+00
water-1	0.001	5	23	22	5.95E-02	3.90E+00
water-2	0.001	5	23	18	1.28E-01	1.52E+00
water-3	0.001	5	23	23	3.54E-01	3.95E+00
water-4	0.001	7	23	18	5.46E-01	1.09E+00
water-5	0.001	4	23	29	2.20E-01	5.46E+00
water-ave	0.001	5.2	23.0	22.0	2.62E-01	3.18E+00
water-1	0.01	5	23	48	1.52E+00	2.79E+00
water-2	0.01	5	23	39	9.19E-01	1.44E+00
water-3	0.01	5	23	29	3.97E-01	2.36E+00
water-4	0.01	7	22	31	9.36E-01	8.57E-01
water-5	0.01	4	23	21	2.20E-01	7.08E+00
water-ave	0.01	5.2	22.8	33.6	7.98E-01	2.90E+00

TABLE 8. Numerical performance of LOQO on NLPs from the CUTEr test suite when warmstarting a problem whose constraint coefficients, A, 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.