Comparison between HYBRID and AHYBRIDM conjugate gradient algorithms

Neculai Andrei
Research Institute for Informatics,
Center for Advanced Modeling and Optimization,
8-10, Averescu Avenue, Bucharest 1, Romania,
Academy of Romanian Scientists, 54,
Splaiul Independentei, Bucharest 5, Romania.
E-mail: nandrei@ici.ro

Elastic-Plastic Torsion

```
   HYBRID Conjugate Gradient Algorithm.
   Convex combination of HS and DY from Newton direction
   with secant condition.
   Powell restart.   June 29, 2009

     1    HYBRID Algorithm. Function Elastic-Plastic Torsion Problem
          stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------------
40000    385   107    597   211       720 -.4392662816729E+00  .6133313955405E-04   18   46  321
-----------------------------------------------------------------------------------------------------
TOTAL    385   107    597   211      7.20 (seconds)    proc=  27.79%

Total # iter for DY=    18   i.e.    4.68%
Total # iter for HS=    46   i.e.   11.95%
Total # iter for CC=   321   i.e.   83.38%
```

```
   AHYBRIDM Conjugate Gradient Algorithm
   Accelerated convex combination of HS,DY:
   from Newton direction with modified  secant condition
   Powell restart.  June 29, 2009

     1    AHYBRIDM Algorithm. Function Elastic-Plastic Torsion Problem
          stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------------
40000    241     0    510    27       593 -.4392678188056E+00  .3175756686388E-04  102  139    0
-----------------------------------------------------------------------------------------------------
TOTAL    241     0    510    27      5.93 (seconds)    proc=    .00%

Total # iter for DY=   102   i.e.   42.32%
Total # iter for HS=   139   i.e.   57.68%
Total # iter for CC=     0   i.e.     .00%
```

Pressure Distribution in a Journal Bearing

```
HYBRID Conjugate Gradient Algorithm.
Convex combination of HS and DY from Newton direction
with secant condition.
Powell restart.   June 29, 2009

  1    HYBRID Algorithm. Function           Pressure Distribution in a Journal Bearing
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------
40000    944   258   1483   538      1827 -.2828929353503E+00  .4395637533633E-04   12   99  833
-----------------------------------------------------------------------------------------------
TOTAL    944   258   1483   538     18.27 (seconds)    proc=  27.33%

Total # iter for DY=    12   i.e.    1.27%
Total # iter for HS=    99   i.e.   10.49%
Total # iter for CC=   833   i.e.   88.24%
```

```
AHYBRIDM Conjugate Gradient Algorithm
Accelerated convex combination of HS,DY:
from Newton direction with modified  secant condition
Powell restart.  June 29, 2009

  1    AHYBRIDM Algorithm. Function       Pressure Distribution in a Journal Bearing
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------
40000    634     0    669    34      1558 -.2828929487236E+00  .2262124595643E-04  263  371    0
-----------------------------------------------------------------------------------------------
TOTAL    634     0    669    34     15.58 (seconds)    proc=    .00%

Total # iter for DY=   263   i.e.   41.48
Total # iter for HS=   371   i.e.   58.52
Total # iter for CC=     0   i.e.     .00
```

Optimal Design with Composite Materials

```
HYBRID Conjugate Gradient Algorithm.
Convex combination of HS and DY from Newton direction
with secant condition.
Powell restart.   June 29, 2009

  1    HYBRID Algorithm. Function           Optimal Design with Composite Materials
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------
40000   3757  1269   5714  1956     12026 -.1138107737064E-01  .1822399466977E-04  108  385 3264
-----------------------------------------------------------------------------------------------
TOTAL   3757  1269   5714  1956    120.26 (seconds)    proc=  33.78%

Total # iter for DY=   108   i.e.    2.87%
Total # iter for HS=   385   i.e.   10.25%
Total # iter for CC=  3264   i.e.   86.88%
```

AHYBRIDM Conjugate Gradient Algorithm
Accelerated convex combination of HS,DY:
from Newton direction with modified secant condition
Powell restart. June 29, 2009

```
  1    AHYBRIDM Algorithm. Function          Optimal Design with Composite Materials
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-------------------------------------------------------------------------------------------------
40000   1025     0   1053    27      4375 -.1138128917301E-01  .3791821681957E-04  143  703  179
-------------------------------------------------------------------------------------------------
TOTAL   1025     0   1053    27     43.75 (seconds)    proc=    .00%

Total # iter for DY=   143   i.e.   13.95
Total # iter for HS=   703   i.e.   68.59
Total # iter for CC=   179   i.e.   17.46
```

Steady State Combustion

HYBRID Conjugate Gradient Algorithm.
Convex combination of HS and DY from Newton direction
with secant condition.
Powell restart. June 29, 2009

```
  1    HYBRID Algorithm. Function Steady State Combustion
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-------------------------------------------------------------------------------------------------
40000    760   203   1183   422      3602 -.5611447607271E+01  .4157611970185E-04   45   79  636
-------------------------------------------------------------------------------------------------
TOTAL    760   203   1183   422     36.02 (seconds)    proc=  26.71%

Total # iter for DY=    45   i.e.    5.92%
Total # iter for HS=    79   i.e.   10.39%
Total # iter for CC=   636   i.e.   83.68%
```

AHYBRIDM Conjugate Gradient Algorithm
Accelerated convex combination of HS,DY:
from Newton direction with modified secant condition
Powell restart. June 29, 2009

```
  1    AHYBRIDM Algorithm. Function Steady State Combustion
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-------------------------------------------------------------------------------------------------
40000    299     0    333    33      1915 -.5611448493596E+01  .2374434222296E-04   29  267    3
-------------------------------------------------------------------------------------------------
TOTAL    299     0    333    33     19.15 (seconds)    proc=    .00%

Total # iter for DY=    29   i.e.    9.70
Total # iter for HS=   267   i.e.   89.30
Total # iter for CC=     3   i.e.    1.00
```

Minimal Surface Area

HYBRID Conjugate Gradient Algorithm.
Convex combination of HS and DY from Newton direction
with secant condition.
Powell restart. June 29, 2009

```
  1    HYBRID Algorithm. Function Minimal Surface Area
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------------
40000    423   128    643   219      1209  .1000000003161E+01  .3259468069911E-04   18   57  348
-----------------------------------------------------------------------------------------------------
TOTAL    423   128    643   219     12.09 (seconds)    proc=  30.26%

Total # iter for DY=    18   i.e.    4.26%
Total # iter for HS=    57   i.e.   13.48%
Total # iter for CC=   348   i.e.   82.27%
```

AHYBRIDM Conjugate Gradient Algorithm
Accelerated convex combination of HS,DY:
from Newton direction with modified secant condition
Powell restart. June 29, 2009

```
  1    AHYBRIDM Algorithm. Function Minimal Surface Area
       stoptest= 1

    n   iter   irs  fgcnt lscnt   time(c)        fxnew              gnorm           DY   HS   CC
-----------------------------------------------------------------------------------------------------
40000    288     3    315    26      1127  .1000000004110E+01  .3601390204558E-04   48  236    4
-----------------------------------------------------------------------------------------------------
TOTAL    288     3    315    26     11.27 (seconds)    proc=   1.04%

Total # iter for DY=    48   i.e.   16.67
Total # iter for HS=   236   i.e.   81.94
Total # iter for CC=     4   i.e.    1.39
```

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