Comparisons:
DESCON versus CG-DESCENT

September 10, 2012

In this paper we compare DESCON versus CG-DESCENT where the number of line search in Wolfe conditions in DESCON is limited to different values. It is worth saying that DESCON uses a procedure of acceleration the conjugate gradient method used. This acceleration procedure changes in a multiplicative way the value of step length determined by the subroutine implementing the Wolfe conditions. Therefore, it is quite natural to limit the maximum number of line search in this subroutine, i.e. the accuracy of the step length computation is not necessary to be very high.

In the first set of numerical experiments we consider max$ls = 5, i.e. the maximum number of line search in the subroutine which implements the Wolfe line search conditions is limited to 5. Figure 1 shows the Dolan and Moré CPU performance profile of DESCON (max$ls=5) versus CG-DESCENT with Wolfe line search.

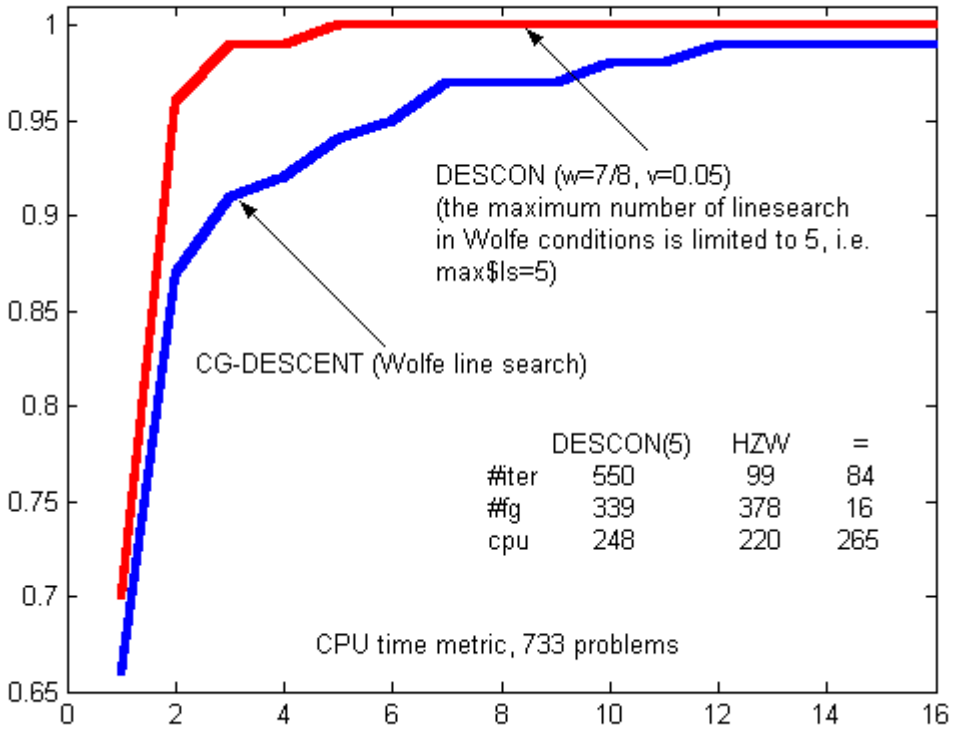

Fig.1. DESCON (max$ls=5) versus CG-DESCENT.

In the second set of numerical experiments we consider max$ls = 6, i.e. the maximum number of line search in the subroutine which implements the Wolfe line search conditions is limited to 6. Figure 2 shows the Dolan and Moré CPU performance profile of DESCON (max$ls=6) versus CG-DESCENT with Wolfe line search.

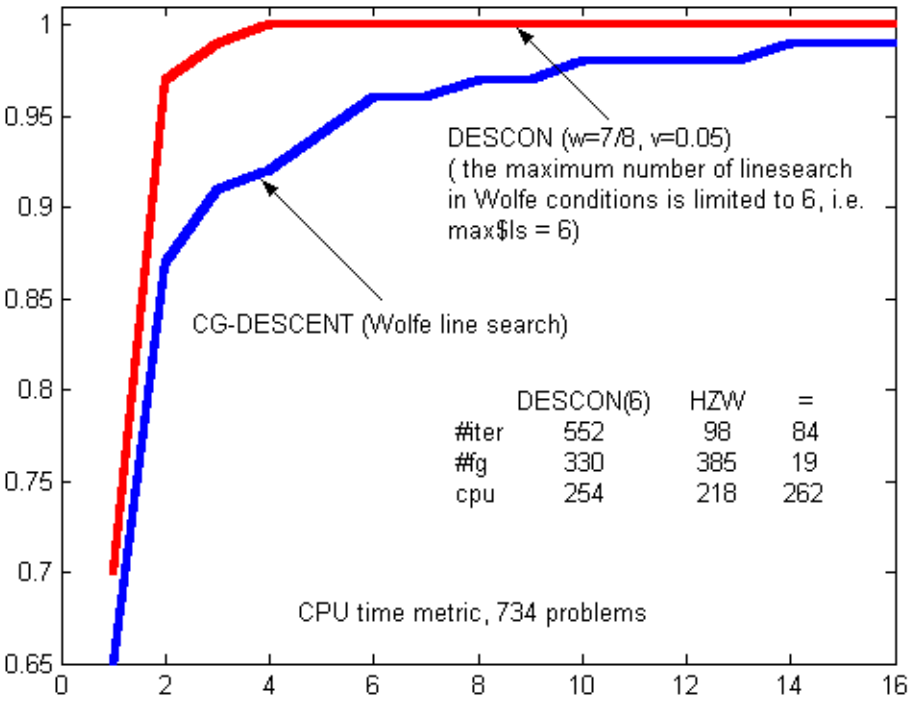

Fig.2. DESCON (max$ls=6) versus CG-DESCENT.

In the third set of numerical experiments we consider max$ls = 8, i.e. in subroutine which implements the Wolfe line searches conditions the maximum number of line searches is limited to 8. Figure 3 presents the performance profile of DESCON (max$ls=8) versus CG-DESCENT.

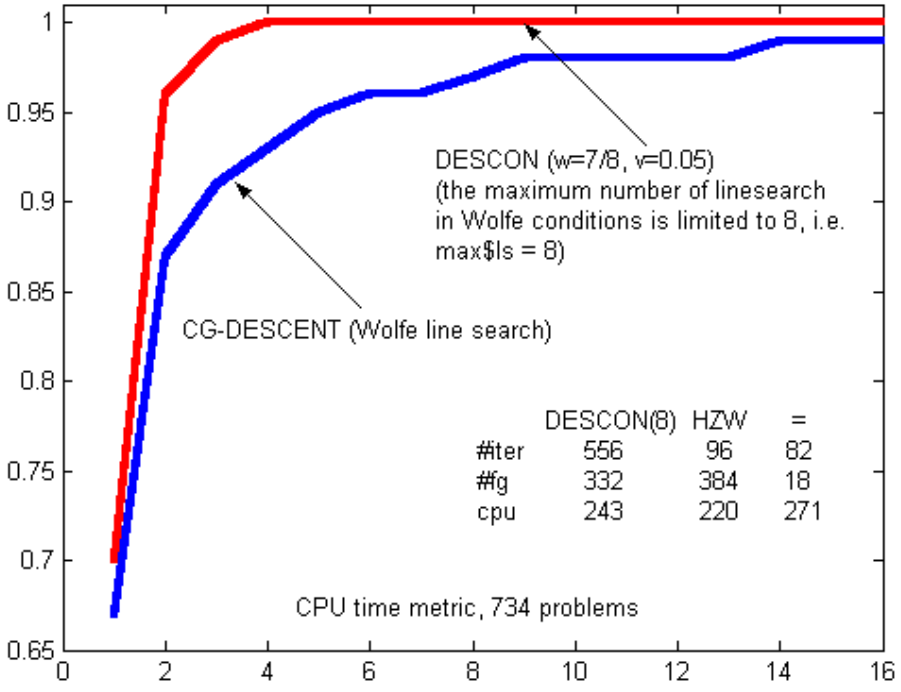

Fig. 3. DESCON (max$ls=8) versus CG-DESCENT.

In the following we compare DESCON (max$ls=5) versus DESCON (max$ls=8) for the same set of test functions used in these numerical experiments. Figure 4, shows the performance profile of DESCON (max$ls=5) versus DESCON (max$ls=8).

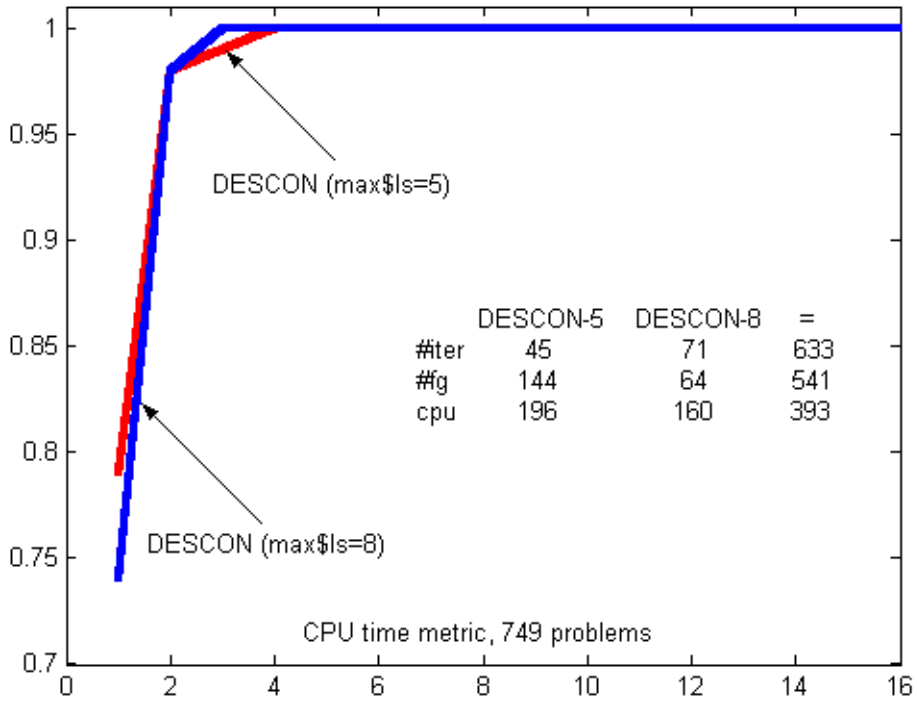

Fig. 4. DESCON (max$ls=5) versus DESCON (max$ls=8).

Figure 5 shows the performance profile of DESCON (max$ls=6) versus DESCON (max$ls=8).

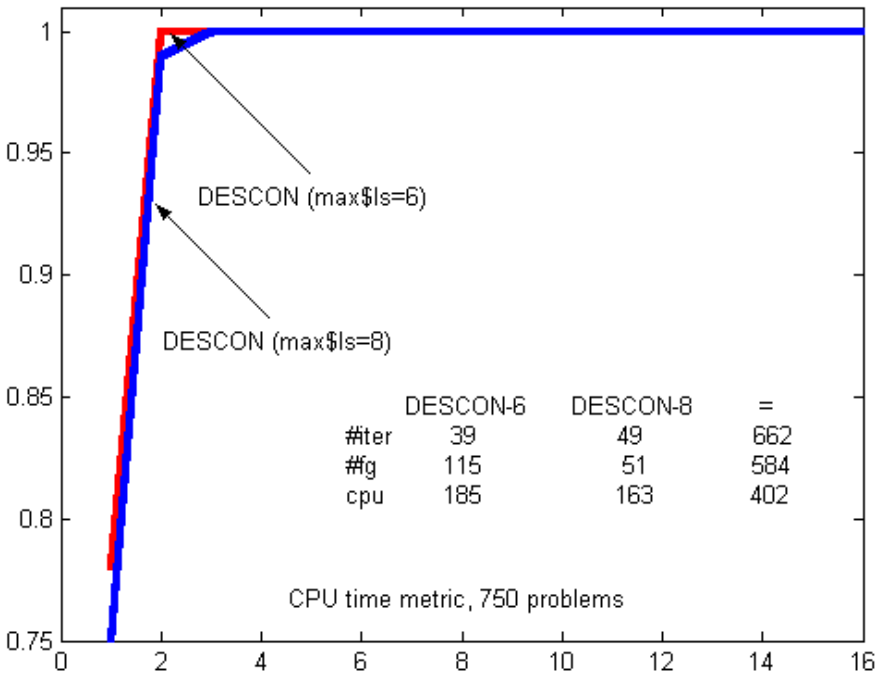

Fig. 5. DESCON (max$ls=6) versus DESCON (max$ls=8).

Observe that DESCON (max$ls=5) is faster that DESCON (max$ls=8). On the other hand DESCON (max$ls=6) is a little faster, and as robust as DESCON (max$ls=8). Therefore, limitation of the maximum number of line searches in the subroutine implementing the Wolfe conditions is a good practice. In fact, the acceleration technique doesn't impose a too high accuracy in the subroutine for step length computation. This gives us the possibility to limit the accuracy of the step length computation.

References

N. Andrei, *Another conjugate gradient algorithm with guaranteed descent and conjugacy conditions for large scale unconstrained optimization.* ICI Technical Report, April 12, 2012.

N. Andrei, *DESCON user's guide and program*. ICI Technical Report, September 10, 2012

N. Andrei, *PERF2N user's guide and program*. ICI Technical Report, September 10, 2012

W. Hager and **H. Zhang**. *CG_DESCENT user's guide.* November 14, 2005.

Neculai Andrei
Research Institute for Informatics
Center for Advanced Modeling and Optimization
8-10, Averescu Avenue, Bucharest 1, ROMANIA