

## Fruitful uses of smooth exact merit functions in constrained optimization

Gianni Di Pillo (dipillo@dis.uniroma1.it)

Giampaolo Liuzzi (liuzzi@dis.uniroma1.it)

Stefano Lucidi (lucidi@dis.uniroma1.it)

Laura Palagi (palagi@dis.uniroma1.it)

*Dipartimento di Informatica e Sistemistica "A. Ruberti"*  
*Università di Roma "La Sapienza"*  
*Via Buonarroti 12, 00185 Roma, Italy*

### Abstract

In this paper we are concerned with continuously differentiable exact merit functions as a mean to solve constrained optimization problems even of considerable dimension. In order to give a complete understanding of the fundamental properties of exact merit functions, we first review the development of smooth and exact merit functions. A recently proposed shifted barrier augmented Lagrangian function is then presented as a potentially powerful tool to solve large scale constrained optimization problems. This latter merit function, rather than directly minimized, can be more fruitfully used to globalize efficient local algorithms, thus obtaining methods suitable for large scale problems. Moreover, by carefully choosing the search directions and the linesearch strategy, it is possible to define algorithms which are superlinearly convergent towards points satisfying first and second order necessary optimality conditions. We propose a general scheme for an algorithm employing such a merit function.

**Keywords:** constrained optimization, continuously differentiable merit functions, primal-dual algorithms.