An adaptive neurodynamic approach based on smoothing approximation for solving non-smooth resource allocation problems

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***Abstract*—In this paper, a smoothing approximation-based adaptive neurodynamic approach is proposed for a nonsmooth resource allocation problem with multiple constraints. The smoothing approximation method is combined with multi-agent systems to avoid the introduction of set-valued subgradient terms, thereby facilitating the practical implementation of the neurodynamic approach. In addition, using the adaptive penalty technique, private inequality constraints are processed, which eliminates the need for additional quantitative estimation of penalty parameters and significantly reduces the computational cost. Moreover, to reduce the impact of smoothing approximation on the convergence of neurodynamic approach, time-varying control parameters are introduced. Thanks to the parallel computing characteristics of multi-agent systems, the neurodynamic approach proposed in this paper is completely distributed. Theoretical proof shows that the state solution of the neurodynamic approach converges to the optimal solution set of NRAP. Finally, two application examples are used to validate the feasibility of the neurodynamic approach.**

***Index Terms*—Neurodynamic approach, Multi-agent system, Adaptive penalty, Smoothing approximation**

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