Application of the Origin-Based Algorithm in a Transit Assignment Problem for Congested Public Transport Systems

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The Transit Assignment Problem for congested public transport systems based on the formulation of De Cea and Fernandez (1993) has asymmetric cost functions that can be solved, among others methods, by the diagonalización procedure. In this work, an implementation of the origin based algorithm proposed by Bar-Gera (1999) is used to solve the convex problems generated by the diagonalización procedure, and the global convergence reached is compared with the one obtained using the Frank-Wolfe algorithm (1956). The origin based algorithm find the flows in arcs based on a common origin, added on all the destinies of the network. This algorithm allows reaching with high precision the equilibrium solution of the assignment problem, with a level of detail similar to the route flows, and accessible memory requirements for the existing technologies. The origin based algorithm was incorporated into the diagonalización procedure implemented in SATURN (Hall and Van Vliet, 2002) to solve a traffic assignment problem with asymmetric cost functions. The reported levels of convergence in this case are better than the ones obtained using the Frank-Wolfe algorithm, whereas the execution times are similar (Bar-Gera and Van Vliet, 2003). On the basis of the work carried by Bar-Gera and Van Vliet, it’s feasible to incorporate the origin based algorithm into the diagonalización procedure in order to solve the transit assignment problem considered. Nevertheless, it’s impossible to predict the results because this problem is different from the traffic assignment problem solved in SATURN where the origin based algorithm was tested, principally due to the topological characteristics of the network where the trips are assigned. This article shows the results of the implementation of the origin-based algorithm in the module of transit assignment for congested public transport systems of the ESTRAUS combined equilibrium model (De Cea et al., 2003). The behavior of the algorithm in the context of the considered problem is analyzed in detail, and the main results founded are discussed.

According to the results, the levels of convergence reached were not as good as the ones obtained from the traffic assignment problem with separable cost functions using the same algorithm. The origin based algorithm, in its actual formulation, tries to transfer flows between the arcs that arrive at a same node and have a same common origin. Then, given the characteristics of this network model, the algorithm has problems to transfer flows and the convergence indicator of the convex problems generated in the diagonalización process does not improve when comparing it with the indicator generated when using the Frank-Wolfe algorithm.

In the analyzed case, the levels of convergence reached were the same as the ones obtained with the Frank-Wolfe algorithm, with less oscillation, but with greater requirements in execution time.