

# Scaled-PAKKT sequential optimality condition for multiobjective problems and its application to an Augmented Lagrangian method

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**Abstract.** Based on the recently introduced Scaled Positive Approximate Karush–Kuhn–Tucker condition for single objective problems, we derive a sequential necessary optimality condition for multiobjective problems with equality and inequality constraints as well as additional abstract set constraints. These necessary sequential optimality conditions for multiobjective problems are subject to the same requirements as ordinary (pointwise) optimization conditions: we show that the updated Scaled Positive Approximate Karush–Kuhn–Tucker condition is necessary for a local weak Pareto point to the problem. Furthermore, we propose a variant of the classical Augmented Lagrangian method for multiobjective problems. Our theoretical framework does not require any scalarization. We also discuss the convergence properties of our algorithm with regard to feasibility and global optimality without any convexity assumption. Finally, some numerical results are given to illustrate the practical viability of the method.

**Keywords:** Nonlinear programming · Augmented Lagrangian methods  
· Global convergence · Sequential optimality conditions

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