"Active set" redirects here. For the band, see The Active Set.

In mathematical optimization, a problem is defined using an objective function to minimize or maximize, and a set of constraints

$$g_1(x) \geq 0, \dots, g_k(x) \geq 0$$

that define the feasible region, that is, the set of all *x* to search for the optimal solution. Given a point x in the feasible region, a constraint

$$g_i(x) \geq 0$$

is called **active** at x if $g_i(x) = 0$ and **inactive** at x if $g_i(x) > 0.$ Equality constraints are always active. The **active set** at x is made up of those constraints $g_i(x)$ that are active at the current point (Nocedal & Wright 2006, p. 308).

The active set is particularly important in optimization theory as it determines which constraints will influence the final result of optimization. For example, in solving the linear programming problem, the active set gives the hyperplanes that intersect at the solution point. In quadratic programming, as the solution is not necessarily on one of the edges of the bounding polygon, an estimation of the active set gives us a subset of inequalities to watch while searching the solution, which reduces the complexity of the search.

Active set methods

In general an active set algorithm has the following structure:

Find a feasible starting point
repeat until "optimal enough"
solve the equality problem defined by the active set (approximately)
compute the Lagrange multipliers of the active set
remove a subset of the constraints with negative Lagrange multipliers
search for infeasible constraints
end repeat

Methods that can be described as **active set methods** include:[1]

- Successive linear programming (SLP)
- Sequential quadratic programming (SQP)
- Sequential linear-quadratic programming (SLQP)
- Reduced gradient method (RG)
- Generalized reduced gradient method (GRG)

References

1. Nocedal & Wright 2006, pp. 467–480

Bibliography

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- Nocedal, Jorge; Wright, Stephen J. (2006). *Numerical Optimization* (2nd ed.). Berlin, New York: Springer-Verlag. ISBN 978-0-387-30303-1..

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