DC-APPROACH FOR EQUILIBRIUM SEARCH IN COURNOT MODEL WITH CUBIC COSTS

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We consider Cournot oligopoly model with players' S-shape costs functions [1], which are given by cubic polynomials:

$$C_i(x_i) = \alpha_i x_i^3 + \beta_i x_i^2 + \gamma_i x_i + \delta_i, \quad \alpha_i > 0, \beta_i < 0, \gamma_i > 0, \delta_i \geq 0, \beta_i^2 \leq 3\alpha_i\gamma_i, \ i \in N,$$

and with linear inverse demand function

$$p(x) = d - a\sum_{j \in N} x_j, \quad a > 0, \ d > 0.$$

Here N is a set of players and $x_i > 0$ is i-th player's output. Since such Cournot model is a potential game [2], any pure-strategy Nash equilibrium is a stationary point of the potential

$$P(x) = \sum_{i \in N}\left[-\alpha_i x_i^3 - (a+\beta_i)x_i^2 + \left(d - \gamma_i - \frac{a}{2}\sum_{j \neq i} x_j\right)x_i\right],$$

which is obviously nonconcave function. Global maximum of P is always equilibrium point.

In order to find global maximum we suggest to use branch-and-bound method, where upper bound concave functions are constructed by linearization of convex term in DC-decomposition of function P.

In the report, we also present numerical experiment results.

REFERENCES

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