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## 具有高投标成本的多属性逆向拍卖博弈模型

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### Game Model on Multi-Attribute Reverse Auctions with Costly Bid

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**摘要** 越来越多像GE这样的大型企业在利用多属性逆向拍卖选择新的供应商采购产品时,通常会设定较高的固定投标成本。针对此情况,建立了三阶段的非合作博弈模型,并利用求解子博弈纳什均衡策略的方法,推导出了供应商的最优投标价格。并得到以下两个主要结论:一是供应商的最优投标策略是按照生产产品真实的质量和交货期进行投标,且投标价格为最优投标价格;二是采购商的最优策略是选择投标价格最高的供应商作为拍卖获胜者,这一违反直觉的结论。这是合理的,因为投标价格最高的供应商也是类型最优的供应商,也即投标质量和投标交货期组合最优的供应商。最后,利用数值实验验证了模型的有效性,并显示出设定相对较高的固定投标成本对采购商来说是有利的。

**关键词:** [电子逆向拍卖](#) [多属性投标](#) [非合作博弈](#) [高投标成本](#) [最优拍卖机制](#)

**Abstract:** Many large companies like GE often utilize multi-attribute (including bid price, quality and lead time) reverse auction to select new suppliers and procure products, and set higher fixed bidding costs in order to improve the efficiency of the online procurement auction. Thus, when the buyer posts up the request for proposal (RFP), the suppliers will decide how to bid to obtain maximum expected revenue depending on the quality and lead time of their own production and fixed bidding costs? Then, the buyer will decide how to select a supplier as the winner of auction to obtain the maximum surpluses according to the bid vector of the suppliers? To solve the above questions, third-stage non-cooperative game model is constructed, and the method which solving the sub-game Nash equilibrium under the perfect information in dynamic game is used. Considering the bid price as the function of bid quality and lead time, the optimal bid price of suppliers is deduced. Furthermore, two results are concluded. First, the optimal bid strategy of suppliers is true production quality and lead time, and bid price is the optimal bid price. Second, the optimal strategy of the buyer is to choose one supplier which has the highest bid price as the winner of the auction. Although this counters intuitive, it is reasonable because that the supplier with the highest bid price is also the best type of supplier which optimal combination of bid quality and lead time. At last, the numerical experiments show that it's benefit to the buyer when the number of suppliers is large or the fixed bidding price is high. In addition, the suppliers can obtain more expected revenue with the improvement of their types, which brings more surpluses for the buyer. This paper reveals that the costly fixed bid costs and multi-attribute reverse auction how to affect the decisions of the firms in supply chain, and provides a reference to research the procurement auction of services products.

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