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Complexity Analysis and Computation of the Optimal Harvesting for One-Species Population Resources

Haiying Jing(1), Zhaoyu Yang(2)

(1)Department of Applied Mathematics, Northeastern University, Shenyang, 110004, China;(2) Department of Management, Shenyang Architectural and Civil Engineering Institute, Shenyang, 110004, China

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摘要 The exploitation of renewable resources creates many complex problems for culture, ecology and economics as well. Ascertaining the essentials behind the complex problems is very important. In this paper, we mainly study various complex relations appearing in the optimal exploitation process for renewable resources. First, we derive a sufficient condition on the existence of optimal harvesting policies for one-species population resources. Then we present every possible optimal harvesting pattern for such a model. On the basis of this, we give a computing formula for estimating the optimal harvesting period, optimal transitional period, and optimal recruitment period. The main difference with respect to the previous works in literature is that our optimal harvesting policy is a piece-wise continuous function of time t, at the piecewise point t_c, which is called switching time. At the switching time we switch the harvesting rate from h to some transitional control u, then to 0. Clearly this kind of harvesting policy is easier to carry out than those by others, provided that there exists a managing department which can highly supervise the resources.

关键词 Complexity optimal harvesting patterns optimal harvesting period optimal switching time optimal transitional period

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Abstract The exploitation of renewable resources creates many complex problems for culture, ecology and economics as well. Ascertaining the essentials behind the complex problems is very important. In this paper, we mainly study various complex relations appearing in the optimal exploitation process for renewable resources. First, we derive a sufficient condition on the existence of optimal harvesting policies for one-species population resources. Then we present every possible optimal harvesting pattern for such a model. On the basis of this, we give a computing formula for estimating the optimal harvesting period, optimal transitional period, and optimal recruitment period. The main difference with respect to the previous works in literature is that our optimal harvesting policy is a piece-wise continuous function of time t, at the piecewise point t_c, which is called switching time. At the switching time we switch the harvesting rate from h to some transitional control u, then to 0. Clearly this kind of harvesting policy is easier to carry out than those by others, provided that there exists a managing department which can highly supervise the resources.

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