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具有二阶环节的导弹最优导引律

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OPTIMAL GUIDANCE LAWS FOR MISSILES WITH SECOND ORDER CHARACTERISTICS

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摘要

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摘要 本文研究了具有二阶环节的导弹其对目标的最优导引律。利用极小值原理分别研究了1)脱靶量为零、最小控制能量指标的最优导引律;2)终态为零控拦截曲面、最小能量指标的最优导引律。最后得出了与具有一阶延迟环导弹所得结果类似,但计算工作量更大,结果应更准确。

关键词:

Abstract: The problem of optimal intercept guidance laws for missiles have been studied by a lot of authors at home and abroad. But the mathematical models for missiles were assumed too simple, i. e. either as an ideal particle or as a first order delay link. As a primary contribution this paper has made researches on the optimal intercept guidance laws based on a mathematical model with second order characteristics. By taking minimum control energy consumption as the performance index, the optimal intercept guidance laws have been derived from the minimum principle in the following two cases of terminal state: 1. The terminal miss-distance is zero; 2. The intercepting curved surface of out-of-control. The conjugate state equations and the state equations have been solved by use of Laplace Transformation. Through considerably complex computation, the optimal intercept guidance laws have been deduced in the following analytical forms. Through appropriate selection of the terminal time t_f or the time of lead T , the results obtained above may be transformed into the optimal guidance laws which are composed of the proportional navigation with varied coefficients and the correctional terms associated with acceleration and angular acceleration of sight-line rotation. These results are similar to those of missiles with first order delay link in form and have no need of any additional parameter. However, the computation is more complex and the results are more accurate. Finally, the optimal intercept guidance laws are studied in the case of the proper frequency of a missile ω approaching to infinity, i. e. in the case of an ideal particle. The results are the same as those obtained by the other authors.

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