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### 一种新的极值搜索算法及其在航空发动机燃烧主动控制中的应用

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### A Novel Extremum Seeking Algorithm and Its Application to Active Control of Combustion in Aeroengines

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摘要

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**摘要** 针对航空发动机存在的不稳定燃烧控制问题, 推导出当发动机不稳定燃烧时, 燃烧室内的振荡压力与平均燃空比值之间的函数模型, 此函数模型构建了压力振荡变化的幅值与平均燃空比值之间的极值关系。提出了一种新颖的退火递归神经网络极值搜索算法, 可以自适应地搜寻出极值模型中最优的平均燃空比值, 实现对燃烧室内压力振荡变化的最小幅值控制, 并有效地抑制了燃烧室的不稳定燃烧现象。通过仿真对比, 验证了方法的有效性。

**关键词:** 退火递归 神经网络 极值搜索算法 航空发动机 不稳定燃烧 主动控制

**Abstract:** The problem of the active control of combustion instabilities in aeroengines is investigated. A function model is derived between the oscillation pressure and the mean fuel-air ratio in the combustion chamber of an aeroengine under unstable combustion, which implicates an extremum relation between the oscillation amplitude of the pressure in the combustion chamber and the mean fuel-air ratio. Moreover, a novel extremum seeking algorithm based on the annealing recurrent neural network is proposed in this article. By means of this method, the control of the minimal oscillation amplitude of the pressure in the combustion chamber can be realized by adaptively seeking the optimal mean fuel-air ratio of this extremum model. This method can effectively restrain the phenomenon of combustion instabilities in an aeroengine. By comparing the simulation results, the effectiveness of the proposed method is validated.

**Keywords:** annealing recurrent neural network extremum seeking algorithm aeroengine combustion instabilities active control

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