Prediction Model for Combustion State of Base Bleed Propellant Based on Perceptron Simulation

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Abstract: The previous investigation shows that the combustion behavior of base bleed propellant is classified to three states under the condition of transient depressurization, which are re-ignition, low frequency oscillation combustion and extinguishment, respectively. Variant combustion state was determined mainly by the maximum pressure before transient depressurization (20 – 90 MPa) and the maximum depressurization velocity ($1.2 \times 10^3 - 6 \times 10^3$ MPa · s^{-1}) during whole process. The relationship of combustion state between the maximum pressure before transient depressurization and the maximum depressurization velocity is linear separable pattern approximately. Two kinds of perceptron models, single layer and double layers, were constructed according to artificial neural networks. Both of the two peceptron models were trained by using test data. The decision boundary of combustion states of base bleed propellant was obtained, which included both the maximum pressure before transient depressurization and the maximum depressurization velocity factors. The correction and reliably of the peceptron were validated by Monte-Carlo random sampling. The peceptrons could be used to predict the combustion behavior of base bleed propellant under the case of transient depressurization, and it was useful to improve design of base bleed unit.

Key words: armament launching theory and technology; combustion state; base bleed propellant; perceptron simulation; classified criterion

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第 25 届国际弹道会议概况

第 25 届国际弹道会议于 2010 年 5 月 17 – 21 日在北京召开。此届会议首次由我国举办,也是首次在亚洲地区举办。会议由中国兵工学会和南京理工大学主办。国际弹道会议是国际常规兵器领域层次最高、信息量最大、最具影响力的学术盛会之一,本次会议参加者主要来自于美国、俄罗斯、法国、德国、英国、印度、意大利、加拿大、澳大利亚、韩国、波兰、瑞典、以色列、比利时、西班牙、巴基斯坦、土耳其、挪威、南非和中国等二十余个国家。大会报告 60 篇,张贴报告近 160 余篇。

会议内容涉及内弹道、外弹道、终点弹道、发射动力学、战斗部机理和设计、创伤弹道、装甲防护、测试技术和爆炸力学等方面。南京理工大学教授、大会执行主席王中原全面介绍了中国在常规兵器、弹道力学和战斗部设计等方面的研究进展和取得的成绩,并展望了未来的发展方向。法国的 R. Cayzac、德国的 Lips Hendrik、俄罗斯的 Vladislav A. Veldanov 和美国的 LaMar Thompson 分别阐述了国际社会在外弹道、弹道力学、终点弹道等研究领域的成果,代表了当前的最高研究水平。美国学者 Thelma G. Manning 等在内弹道研究领域、挪威学者 Jo H Kiran 等在外弹道研究领域、美国学者 J. A. Cordes 等在发射动力学研究领域、美国学者 LaMar Thompson 等在弹道力学研究领域、加拿大华裔学者 Ming Cheng 等在装甲防护研究领域均给出了精彩的报告。

第 26 届国际弹道会议将于明年在美国迈阿密召开。

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