



JPT

# 推进技术

Journal of Propulsion Technology



# 推进技术

第43卷 第1期

总第295期

2022年1月

(月刊)

## 目 次

### 综 述

- 液体火箭发动机智能健康监控技术研究进展 ..... 吴建军, 朱晓彬, 程玉强, 崔孟瑜 (200668)  
液体火箭发动机喷管流动特性及高度补偿研究进展 ..... 刘亚洲, 李 平, 杨建文 (200280)  
离心叶轮背腔复杂流态及调控方法研究进展 ..... 伊卫林, 邓海涛 (200441)

### 总体与系统

- 超声速飞行器综合热管理系统优化设计 ..... 唐 攻, 吉洪湖, 胡娅萍 (200219)  
基于亚燃 RBCC 构型的引射模态一次火箭节流策略研究 .....  
..... 吴亚可, 刘继方, 胡宗纯, 徐卫昌, 杨 晴 (200469)  
一种直升机/发动机系统最经济旋翼转速综合优化方法 .....  
..... 汪 勇, 刘明磊, 宋 劍, 郑前钢, 张海波 (200451)  
变循环发动机模态转换建模及控制规律设计方法研究 ..... 郝 旺, 王占学, 张晓博, 周 莉, 王靖凯 (210058)

### 气动热力学

- 高马赫数来流条件下斜激波与流向涡对相互作用 ..... 马印锴, 李祝飞, 杨基明 (200494)  
动态微涡流发生器对激波/边界层干扰的影响研究 ..... 赵永胜, 张黄伟, 张 江 (200305)  
前缘钝化和化学非平衡效应对斜爆震发动机进气道特性的影响 .....  
..... 代春良, 孙 波, 卓长飞, 马 虎, 周长省 (200751)  
弯曲壁面流动分离及再附的尺度解析模拟 ..... 李文龙, 张波涛, 李 平, 付 平 (200442)  
环下润滑结构内部流动分析和收油叶片结构优化研究 ..... 姜 乐, 刘振侠, 吕亚国, 高晓果 (200251)  
尾迹对低压涡轮端区非定常流动影响的数值研究 .....  
..... 孙 爽, 张哲瑜, 左灿林, 吴兴爽, 潘思睿, 刘福林 (200466)

### 燃烧 传热 传质

- 超燃冲压发动机再生冷却 U型通道的热传导模型研究 ..... 胡家瑛, 王振国, 潘 余, 李佩波 (210401)  
旋转爆震发动机燃烧室壁面烧蚀热防护研究 ..... 田 佳, 谭晓茗, 王元帅, 张靖周 (200225)  
U型脉冲爆震燃烧室的点火起爆工作特性试验研究 ..... 谭汶昊, 郑龙席, 黄 康, 王凌羿 (200742)  
考虑燃料雾化的气液两相连续旋转爆轰数值模拟 ..... 徐 高, 翁春生, 康 楠, 武郁文, 郑 权 (200249)  
空气分配对双旋流燃烧室性能影响的试验研究 ..... 张善军, 郑龙席, 朱 涛, 赵云科 (200229)  
文氏管出口张角对旋流杯流动稳定性的影响 ..... 汪玉明, 王志凯, 江立军, 肖 为, 项禹婷 (200337)  
锥形预混火焰羽流脱落过程的实验诊断 ..... 杨 瑶, 方元祺, 胡科琪, 金 台, 郑 耀, 王高峰 (200566)  
气液比对气液同轴离心式喷嘴缩进室内流动过程的影响 .....  
..... 曹鹏进, 白 晓, 成 鹏, 李清廉, 汪 元 (200861)  
同轴离心式喷嘴燃烧稳定性裕度评估 ..... 杨尚荣, 周晨初, 王牧昕 (200577)

沟槽表面双排孔顺逆组合对气膜冷却的影响 ..... 张子阳, 张 魏, 李广超, 杨 鹏 (200182)  
液体火箭发动机推力室再生冷却流动与传热计算研究 ..... 杨成晓, 王长辉, 徐绍桐 (200639)  
滑油射流冲击旋转壁面的流动换热数值模拟研究 ..... 李炎军, 徐伟鹏, 刘振侠, 吕亚国, 任是璇 (200293)

## 结构 强度 可靠性

叶根缘板过渡处特征模拵件双轴弯曲振动疲劳试验研究 .....  
..... 徐 浩, 李振磊, 石多奇, 王相平, 杨晓光 (210139)  
小孔节流动静压混合式浮动环密封承载与泄漏特性分析 .....  
..... 李 锋, 周婕群, 拜云山, 刘占生, 李明海 (200155)  
基于试验和薄层单元仿真的接触阻尼识别方法 ..... 赵 广, 冯志飞, 侯隆韬, 张韵秋, 李方忠, 马文生 (200270)

## 测试 试验 控制

质量矩固体推进微纳卫星自适应反演控制律设计 ..... 钱鹏俊, 廖文和, 陆正亮, 张 翔 (200645)  
基于深度学习的辅助动力装置性能参数预测方法研究 ..... 王 坤, 侯树贤 (200580)  
双螺杆固液混合燃料输送系统设计与实验研究 ..... 唐 倩, 范小杰, 刘 威, 梁平华, 蔡文哲 (200408)  
Safety and Airworthiness Verification on a Typical Civil Turbofan Engine(英文) ..... 杨 彬 (200415)  
单气泡上浮运动的层析 PIV 实验研究 ..... 左峥瑜, 余文轩, 高 琪, 廖相巍, 赵 亮, 邵雪明 (210037)  
涡扇发动机全包线加速控制计划改进方法研究 ..... 刘子赫, 郑前钢, 刘明磊, 胡春平, 张海波 (200416)  
基于复合推进系统动态模型-状态变量模型的航空发动机直接推力预测控制 .....  
..... 金崇文, 郑前钢, 张海波, 房 娟, 胡忠志 (200524)

## 材料 推进剂 燃料

不同拉伸速率下改性双基推进剂的力学特性 ..... 刘远祥, 胡少青, 张亚俊, 傅学金, 任 黎, 李宏岩 (200757)

## 舰船推进

进、排气壳对全流道大膨胀比涡轮性能影响研究 ..... 柴家兴, 马国骏, 高 杰, 岳国强, 郑 群 (190674)  
船用多级轴流压气机低工况扩稳优化研究 ..... 徐 宁, 李 冬, 汪作心, 万新超 (200378)

## 电推进和其它推进

多模式离子推力器流率特性实验研究 .....  
..... 赵以德, 李建鹏, 郭德洲, 耿 海, 杨 浩, 杨 威, 谷增杰 (200380)  
无加热器空心阴极的击穿电压特性研究 ..... 于 博, 余水淋, 康小录, 赵 青 (200078)

# JOURNAL OF PROPULSION TECHNOLOGY

Vol. 43 No. 1 Sum No. 295

Jan. 2022 (Monthly)

## CONTENTS

### Review

- Research Progress of Intelligent Health Monitoring Technology for Liquid-Propellant Rocket Engines .....  
.....WU Jian-jun, ZHU Xiao-bin, CHENG Yu-qiang, CUI Meng-yu (200668)  
Progress of Flow Characteristics and Altitude Compensation in Liquid Rocket Engine Nozzle .....  
.....LIU Ya-zhou, LI Ping, YANG Jian-wen (200280)  
Review of Complex Flow Status and Control Methods for Rear Disk Cavity in Centrifugal Impeller .....  
.....YI Wei-lin, DENG Hai-tao (200441)

### System

- Optimal Design of Comprehensive Thermal Management System for Supersonic Vehicle .....  
.....TANG Mei, JI Hong-hu, HU Ya-ping (200219)  
Throttling Strategy of Primary Rocket in Ejector Mode on a Ramjet-Mode-Designed RBCC Structure .....  
.....WU Ya-ke, LIU Ji-fang, HU Zong-chun, XU Wei-chang, YANG Qing (200469)  
Integrated Optimization Method of the Most Economical Rotor Speed for Helicopter/Engine System .....  
.....WANG Yong, LIU Ming-lei, SONG Jie, ZHENG Qian-gang, ZHANG Hai-bo (200451)  
Mode Transition Modeling and Control Law Design Method of Variable Cycle Engine .....  
.....HAO Wang, WANG Zhan-xue, ZHANG Xiao-bo, ZHOU Li, WANG Jing-kai (210058)

### Aero-thermodynamics

- Oblique Shock Wave/Streamwise-Vortex-Pair Interaction at a High Mach Number .....  
.....MA Yin-kai, LI Zhu-fei, YANG Ji-ming (200494)  
Effects of Dynamic Micro Vortex Generator on Shock Wave Boundary Layer Interactions .....  
.....ZHAO Yong-sheng, ZHANG Huang-wei, ZHANG Jiang (200305)  
Influence of Leading Edge Blunt and Chemical Non-Equilibrium Effect on Characteristics of Inlet of Oblique Detonation Engine .....  
.....DAI Chun-liang, SUN Bo, ZHUO Chang-fei, MA Hu, ZHOU Chang-sheng (200751)  
Scale-Resolving Simulations of Flow Separation from Curved Surfaces and Subsequent Reattachment .....  
.....LI Wen-long, ZHANG Bo-tao, LI Ping, FU Ping (200442)  
Internal Flow Field Analysis and Optimization Structure of Oil Scoop Blade in Under-Race Lubrication Structure .....  
.....JIANG Le, LIU Zhen-xia, LYU Ya-guo, GAO Xiao-guo (200251)  
Numerical Investigation of Wakes on Endwall Unsteady Flow Inside Low Pressure Turbine .....  
.....SUN Shuang, ZHANG Zhe-yu, ZUO Can-lin, WU Xing-shuang, PAN Si-rui, LIU Fu-lin (200466)

### Combustion, Heat and Mass Transfer

- Heat Conduction Model in U-Shaped Regenerative Cooling Channel in Scramjet .....  
.....HU Jia-ying, WANG Zhen-guo, PAN Yu, LI Pei-bo (210401)  
Ablation Thermal Protection of Combustor Wall in a Rotating Detonation Engine .....  
.....TIAN Jia, TAN Xiao-ming, WANG Yuan-shuai, ZHANG Jing-zhou (200225)  
Experimental Investigation on Ignition and Detonation Characteristics of U-Bend Pulse Detonation Combustor .....  
.....TAN Wen-hao, ZHENG Long-xi, HUANG Kang, WANG Ling-yi (200742)  
Numerical Simulation of Gas-Liquid Two-Phase Continuous Rotating Detonation Considering Fuel Atomization .....  
.....XU Gao, WENG Chun-sheng, KANG Nan, WU Yu-wen, ZHENG Quan (200249)  
Experimental Investigation of Effects of Airflow Distribution on Double Swirler Combustor Performance .....  
.....ZHANG Shan-jun, ZHENG Long-xi, ZHU Tao, ZHAO Yun-ke (200229)  
Effects of Venturi Divergence Angle on Flow Instability of Swirl Cup .....  
.....WANG Yu-ming, WANG Zhi-kai, JIANG Li-jun, XIAO Wei, XIANG Yu-ting (200337)  
Experimental Diagnosis of Flame Flickering in Premixed Conical Flame .....  
.....YANG Yao, FANG Yuan-qi, HU Ke-qi, JIN Tai, ZHENG Yao, WANG Gao-feng (200566)

- Effects of Gas-Liquid Ratio on Internal Flow Dynamics of Gas-Liquid Swirl Coaxial Injector in Recess Chamber ..... CAO Peng-jin, BAI Xiao, CHENG Peng, LI Qing-lian, WANG Yuan (200861)
- Combustion Stability Margin Assessment of Two Swirl Coaxial Injectors ..... YANG Shang-rong, ZHOU Chen-chu, WANG Mu-xin (200577)
- Effects of Forward and Backward Combinations with Two Rows of Holes on Film Cooling of Grooved Surface ..... ZHANG Zi-yang, ZHANG Wei, LI Guang-chao, YANG Peng (200182)
- Calculation Study on Flow and Heat Transfer of Regenerative Cooling in Liquid Rocket Engine Thrust Chamber ..... YANG Cheng-xiao, WANG Chang-hui, XU Shao-tong (200639)
- Numerical Study of Flow and Heat Transfer Characteristics of Oil Jet Impingement on Rotating Wall ..... LI Yan-jun, XU Wei-peng, LIU Zhen-xia, LYU Ya-guo, REN Shi-xuan (200293)

## **Structure, Strength and Reliability**

- Experimental Investigation on Biaxial Bending Vibration Fatigue of Blade-Like Specimen for Fillet Between Airfoil and Platform ..... XU Hao, LI Zhen-lei, SHI Duo-qì, WANG Xiang-ping, YANG Xiao-guang (210139)
- Load Capacity and Leakage Analysis of Hybrid Floating Ring Seals with Throttle Orifices ..... LI Feng, ZHOU Jie-qun, BAI Yun-shan, LIU Zhan-sheng, LI Ming-hai (200155)
- Contact Damping Identification Method Based on Experiment and Thin Layer Element Simulation ..... ZHAO Guang, FENG Zhi-fei, HOU Long-tao, ZHANG Yun-qiu, LI Fang-zhong, MA Wen-sheng (200270)

## **Test, Experiment and Control**

- Design of Adaptive Backstepping Control for Moving Mass Micro-nano Satellite with Solid Rocket Motor ..... QIAN Peng-jun, LIAO Wen-he, LU Zheng-liang, ZHANG-Xiang (200645)
- Prediction Method of Auxiliary Power Unit Performance Parameter Based on Deep Learning ..... WANG Kun, HOU Shu-xian (200580)
- Design and Experimental Study of Solid Liquid Mixed Fuel Supply System with Twin Screw ..... TANG Qian, FAN Xiao-jie, LIU Wei, LIANG Ping-hua, CAI Wen-zhe (200408)
- Safety and Airworthiness Verification on a Typical Civil Turbofan Engine ..... YANG Bin (200415)
- Tomographic PIV Experimental Study on Motion of Rising Single Bubble ..... ZUO Zheng-yu, SHE Wen-xuan, GAO Qi, LIAO Xiang-wei, ZHAO Liang, SHAO Xue-ming (210037)
- Improvement Method of Turbofan Engine Full-Envelope Acceleration Control Schedule ..... LIU Zi-he, ZHENG Qian-gang, LIU Ming-lei, HU Chun-ping, ZHANG Hai-bo (200416)
- Direct Thrust Predictive Control of Aeroengine Based on Compact Propulsion System Dynamic Model-State Variable Model ..... JIN Chong-wen, ZHENG Qian-gang, ZHANG Hai-bo, FANG Juan, HU Zhong-zhi (200524)

## **Material, Propellant and Fuel**

- Mechanical Properties of Modified Double-Base Propellant under Different Tensile Rates ..... LIU Yuan-xiang, HU Shao-qing, ZHANG Ya-jun, FU Xue-jin, REN Li, LI Hong-yan (200757)

## **Ship Propulsion**

- Effects of Inlet and Exhaust Casings on Performance of Turbine with Large Expansion Ratio of Full Flow ..... CHAI Jia-xing, MA Guo-jun, GAO Jie, YUE Guo-qiang, ZHENG Qun (190674)
- Optimization of Low-Condition Stability Extension in Marine Multistage Axial Compressor ..... XU Ning, LI Dong, WANG Zuo-xin, WAN Xin-chao (200378)

## **Electric Propulsion and Other Advanced Propulsion**

- Experimental Study on Flow Rate Characteristic of Multi-Mode Ion Thruster ..... ZHAO Yi-de, LI Jian-peng, GUO De-zhou, GENG Hai, YANG Hao, YANG Wei, GU Zeng-jie (200380)
- An Investigation of Breakdown Voltage Characteristics in Heaterless Hollow Cathode ..... YU Bo, YU Shui-lin, KANG Xiao-lu, ZHAO Qing (200078)