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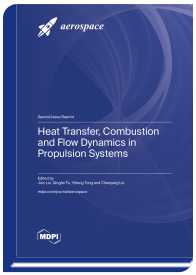
Special Issue Reprint

Heat Transfer, Combustion and Flow Dynamics in Propulsion Systems



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Propulsion systems based on chemical reaction principles are still the most widely used thrust devices for aircrafts, drawing a lot of research attention. Whether in traditional propulsion systems including aero-engines, rocket engines, ramjets and scramjets, or new developed combined power systems (such as TBCCs and RBCCs), thermal protection, flow dynamics and combustion instabilities in engine systems are still major concerns, especially for high-speed aircraft. Thermal protection has become the biggest issue for hypersonic aircraft experiencing extremely high external aerodynamic heating and internal combustion heat release. Another challenging issue is the risk of combustion instability inside some propulsion systems, which couples with an unsteady heat release process and leads to high thermal load. Some optimized or novel design, analysis and simulated methods have been applied to the structural design, heat transfer and flow dynamics of propulsion systems. New measurement methods have been proposed to realize clear and accurate visualizations of flow field and combustion products, such as high-resolution PIV and burst-mode high frequency LIF. In addition, new concepts have been proposed aiming at improving the efficiency of propulsion systems, such as the application of powder fuel instead of traditional fuels and the application of supercritical fluids and nanofluids in thermal management systems.

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