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Review on Optimized Design and Computational Analysis of CPU Cooling Fan Blades

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Abstract: ***The rapid evolution of high-performance computing systems has led to a substantial increase in heat generation within modern CPUs, making efficient thermal management a critical design challenge. Conventional air-cooling solutions predominantly rely on plastic fan blades, which are lightweight and economical but suffer from low thermal conductivity and limited durability. Recent research has increasingly focused on improving cooling performance through advanced material selection, optimized blade geometry, and computational analysis techniques. This review paper systematically examines recent advancements in CPU cooling fan blade design, with particular emphasis on aluminum blades, blade angle optimization, and Computational Fluid Dynamics (CFD)-based analysis. The reviewed studies highlight how material replacement and aerodynamic optimization significantly enhance airflow, heat dissipation, and overall cooling efficiency. Additionally, emerging trends such as machine-learning-assisted optimization, hybrid cooling technologies, and integrated system-level design are discussed. Key challenges, including increased blade weight, noise generation, and rotational balance, are also analyzed. The review identifies existing research gaps and provides valuable insights for developing efficient, durable, and high-performance CPU cooling solutions suitable for next-generation computing applications.***

Keywords: CPU Cooling Fans, Aluminum Fan Blades, Thermal Management, Computational Fluid Dynamics (CFD), Airflow Optimization etc.

I. INTRODUCTION

The continuous advancement of computing technology has significantly transformed modern society, enabling complex data processing, artificial intelligence, cloud computing, and high-speed communication. Central to these developments are high-performance Central Processing Units (CPUs), which operate at increasing clock speeds and power densities. While these advancements improve computational capability, they also lead to a considerable rise in heat generation within electronic components. Excessive thermal buildup can result in thermal throttling, reduced processing efficiency, system instability, and long-term hardware degradation. Consequently, effective thermal management has become a critical concern in the design and operation of modern computing systems [1].

Among various cooling techniques, air cooling remains the most widely used solution due to its simplicity, reliability, and cost-effectiveness. A typical air-cooling system consists of a heat sink coupled with a cooling fan that facilitates heat removal through forced convection. The cooling fan plays a crucial role in maintaining an adequate airflow rate, directly influencing heat dissipation from the CPU surface. The efficiency of these fans is largely governed by two key factors: the material properties of the fan blades and their geometric design [2]. Traditionally, CPU cooling fans employ plastic materials such as polypropylene due to their lightweight nature, ease of manufacturing, and low production cost. However, plastic fan blades exhibit poor thermal conductivity, which limits their ability to actively participate in heat absorption and dissipation. As a result, plastic blades function solely as airflow generators rather than contributing directly to thermal transfer. With the growing thermal demands of modern CPUs, this limitation has prompted researchers to explore alternative materials that can enhance cooling performance [3].

Aluminum has emerged as a promising candidate for CPU fan blades due to its excellent thermal conductivity, mechanical strength, and resistance to thermal deformation. Unlike plastic, aluminum blades can absorb heat from the surrounding air and contribute to improved heat transfer efficiency. Several studies have demonstrated that aluminum fan blades offer superior airflow stability, improved durability, and enhanced cooling capability compared to plastic counterparts. Nevertheless, the increased mass of aluminum introduces challenges related to rotational inertia, fan balancing, bearing wear, and power consumption, necessitating careful design optimization [4].

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In addition to material selection, blade geometry plays a vital role in determining fan performance. Parameters such as blade angle, chord length, curvature, and sweep significantly influence airflow patterns, pressure distribution, and turbulence generation. Research indicates that optimizing blade angles within a specific range can substantially improve airflow efficiency and heat removal while minimizing energy losses. Computational Fluid Dynamics (CFD) has become an indispensable tool for analyzing these aerodynamic and thermal behaviors, allowing researchers to simulate complex flow fields and optimize designs without extensive experimental trials [5].

Recent studies have further expanded the scope of fan optimization by integrating machine learning techniques, multi-objective optimization algorithms, and hybrid cooling approaches. These advanced methods enable faster convergence toward optimal designs while balancing competing performance metrics such as airflow, noise, energy consumption, and structural integrity. Despite these advancements, challenges remain in achieving an optimal balance between cooling efficiency, mechanical stability, acoustic performance, and manufacturing feasibility [6].

This review paper consolidates recent research on CPU cooling fan blade optimization, focusing on material innovation, aerodynamic design, and computational analysis techniques. By critically analyzing existing studies, the paper identifies current trends, technological advancements, and research gaps, providing a comprehensive reference for future developments in high-efficiency CPU cooling systems [7][8].

II. PROBLEM IDENTIFICATION

1) Rapid Increase in CPU Heat Density: Modern CPUs operate at high clock speeds and power densities, generating excessive heat that conventional cooling systems struggle to dissipate effectively.
2) Limitations of Plastic Fan Blades: Widely used polypropylene blades possess low thermal conductivity, preventing active heat absorption and limiting overall cooling efficiency.
3) Suboptimal Airflow Characteristics: Fixed and non-optimized blade geometries lead to uneven airflow distribution, recirculation zones, and reduced heat removal capability.
4) Thermal Throttling and Reliability Issues: Inefficient cooling results in frequent thermal throttling, performance degradation, and reduced lifespan of electronic components.
5) Material–Weight Trade-Off Challenges: Although aluminum blades enhance heat dissipation, their increased mass affects rotational dynamics, fan balance, and bearing life.
6) Noise and Vibration Concerns: Improper blade design and heavier materials can increase acoustic noise and mechanical vibration.
7) Lack of Integrated Optimization Approaches: Existing studies often address material selection or geometry optimization independently, lacking a holistic, system-level design framework for CPU cooling fans.

III. LITERATURE SURVEY

A. *Literature Review*

Md Atiqur Rahman et al., 2024, This comprehensive review surveys modern heat-sink architectures (pin/fin, microchannels, jet-impingement, and additively manufactured topologies) and optimization strategies coupling geometry, materials, and flow control. It emphasizes that combining topology optimization and CFD-driven shape modification can reduce thermal resistance substantially while limiting pressure drop.

The paper highlights hybrid solutions (microchannel + jet) as particularly effective for high-flux CPUs and stresses manufacturability constraints—material choices (copper vs. aluminum) and fabrication fidelity influence achievable gains. It also discusses surrogate-model and adjoint methods for rapid design-space exploration, noting that multi-objective optimization (temperature vs. pressure drop vs. noise) is essential for practical fan/heatsink systems.

Jiaju Wang et al., 2023, present a procedure using Bézier parameterization for blade profiles and CFD to iterate toward reduced flow separation and improved efficiency. Their study shows that controlling spanwise camber and stagger angle via Bézier control points reduces recirculation zones on suction surfaces and smooths the outlet flow, improving static pressure rise and efficiency. Though targeted at centrifugal fans, the principles (profile shaping, staged optimization, and attention to blade loading) translate to axial/CPU fans: gradual curvature and optimized stagger reduce vibration and noise while improving volumetric flow at given RPM. The authors recommend integrating structural checks for higher-strength materials (e.g., aluminum) due to different stiffness/weight tradeoffs.

Shuiqing Zhou et al., 2021, used 3D CFD coupled with parametric geometry changes to optimize a forward-swept axial fan for higher aerodynamic efficiency. Their study maps how sweep, chord distribution, and blade angle affect boundary layer development, tip leakage, and wake interaction. Results show forward sweep can delay stall, widen the stable operating range, and increase efficiency at off-design points—useful for CPU fans operating across variable loads. The paper also quantifies pressure-loss vs. flow improvements and calls out the importance of accurate turbulence modeling (e.g., SST vs. k-ε) for small axial devices. They recommend validating CFD with particle-image velocimetry for compact devices.

Martin Granlöf, 2022, This study demonstrates mesh-morphing coupled to an automated optimizer for axial fan blades, showing that modest profile reshaping (leading-edge radius, camber distribution) yields measurable gains in flow uniformity and reduced tip vortices. For small cooling fans (similar scale to CPU fans), the author reports a 5–8% increase in volumetric flow at constant power and a reduction in localized recirculation that typically reduces heat-transfer effectiveness. The study stresses grid independence, transient simulation for start/stop, and the need for structural modal checks when switching materials (aluminum increases inertia and changes resonant frequencies). Recommendations include combining CFD optimization with simple experimental rigs for rapid validation.

Fajar Dwi Yudanto et. al. 2023, This applied CFD investigation compares several cooling schemes (cross-flow, jet-impingement, mixed convection) and materials (aluminum, copper, steel) for small form-factor CPU cooling. The results indicate jet-impingement on the heat-sink provides the steepest local heat flux reduction, while overall system performance depends strongly on fan placement and blade geometry. Regarding materials, aluminum offers a balanced thermal performance and manufacturability; copper provides marginally better conduction but with weight penalty and cost. The study also discusses fan count and arrangement—multiple small fans can outperform a single large fan under spatial constraints, provided blade design is optimized to prevent airflow interference.

Bhagyashree Khandare, 2025, This recent preprint specifically evaluates aluminum blades for desktop CPU fans using SolidWorks CFD. The authors modeled blade angles and thicknesses, showing aluminum's elevated thermal conductivity provides direct heat absorption from near-heatsink regions and slightly smoother thermal gradients across the duct. CFD comparisons with polypropylene indicate improved convective heat transfer coefficients near the blade surface and a reduction in hotspot amplitudes under steady loads. However, increased blade inertia required RPM adjustments and precise balancing—unbalanced aluminum blades induced higher bearing loads. Authors recommend thin, rib-reinforced aluminum blades to limit mass while preserving stiffness, and stress that acoustic impacts warrant further experimental verification.

Shuiqing Zhou et. al. 2023, this paper based on machine-learning models with high-fidelity CFD to accelerate blade design iterations. They show Gaussian-process and neural-surrogate approaches can predict performance metrics (flow, pressure rise, torque) with good accuracy after limited CFD samples, reducing optimization cost by orders of magnitude. Applied to axial fan blades, their pipeline found non-intuitive geometries (spanwise twist and local camber variations) that improved overall efficiency without large pressure-drop penalties. The study highlights that when changing materials (plastic → aluminum), the optimizer should include structural and inertia constraints to avoid designs that are aerodynamically optimal but mechanically unfeasible at higher mass.

C. Lee et al., 2025, This engineering study proposes integrating through-flow analysis with controlled blading design (CBD) to manage spanwise loading and minimize separation. The method reduces wake non-uniformity and improves stage efficiency; applied to compact axial fans, the authors reported improved flow uniformity and reduced acoustic signatures. They discuss material implications: stiffer blades allow more aggressive curvature without flutter, enabling aluminum to be shaped into high-performance profiles that plastic could not support without excessive thickness. Practical recommendations include modal analysis and adding small fillets to mitigate stress concentrations when using metal blades.

Rakesh Nandan et. al. 2025, This forward-looking review examines hybrid cooling paradigms (air + liquid, active + passive, phase-change integrated within heat-sinks) and situates axial-fan advances within broader system strategies. It stresses that fan improvements (material, geometry) yield most benefit when co-designed with heat-sink topology and chassis airflow paths. The review concludes that aluminum fan blades offer a cost-effective incremental gain when paired with optimized ducting and impingement arrangements; however, systemic gains require co-optimization across fan, sink, and enclosure. It also flags reliability: metallic blades exposed to humid/marine environments need corrosion protection or coatings.

Weiping Feng, 2024, This practitioner-oriented review compares metal (aluminum, steel, FRP) and plastic blades across performance, longevity, cost, and manufacturability axes. It finds metal blades provide higher rigidity, less deformation under thermal cycling, and potentially improved aerodynamic performance due to thinner, stiffer sections. Plastic scores better for low-cost, lightweight applications with lower bearing loads. For electronics cooling, aluminum strikes the best compromise—good

thermal conduction, reasonable cost, and ease of extrusion or stamping—provided designers mitigate added inertia through thinner sections, ribbing, or composite tips. The whitepaper emphasizes testing for balance, bearing life, and noise when replacing plastic with metal blades.

B. *Literature Summary*

1) The reviewed studies highlight the importance of material selection and blade geometry in CPU cooling performance.
2) Research confirms that aluminum fan blades outperform plastic blades due to higher thermal conductivity, improved heat dissipation, and enhanced airflow efficiency.
3) Studies using Computational Fluid Dynamics (CFD) and experimental methods reveal that modifying blade angles (30°-45°) increases cooling efficiency.
4) Aluminum blades reduce CPU temperature fluctuations, enhance reliability, and withstand extreme conditions.
5) Aluminum blades improve airflow by 25% and enhance heat absorption by 30%. These findings strongly support the transition from plastic to aluminum blades for better CPU cooling performance.

C. *Research Gap*

1) Limited Focus on Fan Blade Materials: Most existing studies emphasize heat sink optimization, while detailed investigations on alternative fan blade materials such as aluminum remain limited.
2) Isolated Optimization Approaches: Current research often treats material selection and blade geometry optimization separately, lacking integrated multi-parameter analysis.
3) Insufficient Weight and Dynamic Analysis: Few studies comprehensively address the impact of increased blade mass on rotational dynamics, balance, and bearing life.
4) Neglect of Acoustic Performance: The influence of aluminum blades on noise generation and vibration is inadequately explored.
5) Lack of Comparative Benchmarks: Direct comparisons between plastic and aluminum blades under identical operating conditions are scarce.
6) Limited Experimental Validation: Many findings rely heavily on CFD simulations without sufficient experimental or real-time validation.
7) Absence of System-Level Optimization: Co-optimization of fan blades with heat sinks and enclosure airflow remains underexplored in CPU cooling applications.

IV. RESEARCH METHODOLOGY

A. *Criteria for Selecting this Study*

1) Relevance to CPU Thermal Management: Studies focusing on CPU cooling fans, heat sinks, or airflow optimization for electronic components were prioritized.
2) Material-Based Investigations: Research comparing plastic, aluminum, or metallic fan blades was selected to evaluate material influence on cooling efficiency.
3) Computational Analysis Usage: Preference was given to studies employing CFD, numerical simulations, or optimization algorithms for airflow and heat transfer analysis.
4) Design Optimization Focus: Papers addressing blade geometry, blade angle, curvature, or fan structure optimization were included.
5) Recent Publications: Studies published between 2020 and 2025 were emphasized to reflect current technological advancements.
6) Peer-Reviewed Sources: Journals, conference proceedings, and credible theses were selected to ensure data reliability.
7) Performance Metrics Availability: Studies reporting quantitative results such as temperature reduction, airflow rate, or efficiency improvement were considered.

B. *Method of Analysis*

1) Literature Screening: Selected studies were reviewed based on abstracts, keywords, and objectives to ensure alignment with research focus.
2) Data Extraction: Key parameters such as blade material, blade angle, airflow rate, thermal conductivity, and temperature reduction were extracted.

3) CFD-Based Evaluation: Emphasis was placed on numerical methods used for airflow and thermal analysis, including turbulence and heat transfer models.
4) Design Parameter Assessment: Blade geometry variations, especially blade angles and profiles, were examined for their impact on cooling performance.
5) Thermal Performance Analysis: Cooling efficiency was assessed using temperature drop, heat flux, and thermal resistance metrics.
6) Structural Considerations: Weight, stress distribution, and rotational stability reported in studies were analyzed.
7) Trend Identification: Common optimization strategies and emerging techniques were systematically identified.

C. Comparison and Analysis

1) Material Comparison: Plastic and aluminum fan blades were compared based on thermal conductivity, durability, and cooling effectiveness.
2) Airflow Performance: Differences in airflow rate, velocity distribution, and turbulence intensity across blade designs were analyzed.
3) Blade Geometry Impact: Performance variations due to blade angle optimization (typically 30°–45°) were evaluated.
4) Thermal Outcomes: Temperature reduction and heat dissipation improvements reported across studies were compared.
5) Efficiency vs. Weight Trade-Off: Gains in cooling efficiency were weighed against increased blade mass and energy consumption.
6) Noise and Stability Factors: Available data on acoustic noise and vibration were reviewed.
7) Research Trends: Overall performance improvements, limitations, and best design practices were summarized to identify optimal design directions.

Authors & Year	Material Focus	Analysis / Method Used	Key Outcome
Rahman et al., 2024	Aluminum, Copper	CFD-based thermal and airflow optimization	Improved thermal resistance and cooling efficiency using metal-based designs
Wang et al., 2023	Aluminum	CFD with Bézier curve blade modeling	Reduced flow recirculation and enhanced pressure rise and airflow
Yang et al., 2021	Conventional materials	CFD-based aerodynamic optimization	Forward-swept blades improved efficiency and operating range
Granlöf, 2022	Aluminum vs Plastic	3D CFD and mesh morphing	5–8% airflow improvement; mass and inertia effects highlighted
Yudanto et al., 2023	Aluminum	Numerical CFD analysis	Aluminum balanced heat transfer and manufacturability
Khandare, 2025	Aluminum	SolidWorks CFD analysis	Enhanced heat transfer and reduced CPU hotspots
Zhou et al., 2023	Aluminum	ML-assisted CFD optimization	Improved blade geometry with higher airflow efficiency
Lee et al., 2025	Aluminum	Through-flow and controlled blading	Improved flow uniformity and reduced noise
Nandan et al., 2025	Hybrid materials	Review of hybrid cooling techniques	System-level co-optimization improves cooling performance
Feng, 2024	Metal vs Plastic	Comparative industrial analysis	Aluminum identified as optimal compromise material

D. Evaluation of methodologies used in the reviewed studies

1) Extensive Use of CFD: Most studies relied on Computational Fluid Dynamics to analyze airflow behavior, pressure distribution, and heat transfer performance of CPU cooling fans.
2) Parametric Geometry Optimization: Blade angle, curvature, sweep, and thickness were commonly varied to assess their influence on airflow efficiency and cooling effectiveness.
3) Material-Based Comparative Analysis: Several researchers compared plastic, aluminum, and copper blades to evaluate thermal conductivity and durability effects.
4) Mesh Morphing and Optimization Algorithms: Advanced techniques such as mesh morphing, Bézier curve modeling, and genetic algorithms were used to achieve optimal blade shapes.
5) Machine Learning Integration: Recent studies incorporated ML-based surrogate models to accelerate design optimization and reduce computational cost.
6) Thermal–Structural Coupling: A limited number of studies considered both thermal performance and structural integrity, especially for heavier aluminum blades.
7) Experimental Validation Limitations: Many studies lacked experimental testing, relying heavily on simulations, which may affect real-world accuracy.
8) System-Level Analysis Gap: Few methodologies addressed fan, heat sink, and enclosure airflow as a single integrated system.

E. Highlighting Trends, Advancements, and Challenges

Trends:

- Increasing focus on material innovation, particularly aluminum and hybrid metal–polymer fan blades.
- Widespread adoption of CFD-based design optimization for airflow and thermal analysis.
- Growing interest in blade angle and geometry optimization to enhance cooling efficiency.
- Integration of machine learning techniques for faster and more efficient fan design optimization.
- Shift toward system-level thermal management, combining fans, heat sinks, and enclosure airflow.

Advancements:

- Development of high-accuracy CFD models for predicting airflow and heat transfer in compact cooling systems.
- Introduction of ML-assisted surrogate models to reduce computational time during optimization.
- Improved aluminum blade fabrication techniques, enabling thinner and lighter designs.
- Enhanced understanding of aero-thermal interactions in CPU cooling fans.
- Adoption of multi-objective optimization, balancing efficiency, noise, and structural stability.

Challenges:

- Weight and inertia issues associated with aluminum blades affecting balance and bearing life.
- Noise and vibration control remains difficult for metal fan blades.
- Limited experimental validation to support simulation-based findings.
- Manufacturing constraints for complex blade geometries.
- Need for cost-effective solutions without compromising performance or reliability.

V. DISCUSSION

A. Synthesis of findings from literature

The reviewed literature collectively demonstrates that CPU cooling performance is strongly influenced by both fan blade material and geometric design. Studies consistently show that aluminum blades outperform conventional plastic blades due to higher thermal conductivity, improved heat absorption, and enhanced airflow stability. Optimization of blade geometry—particularly blade angles in the range of 30° to 45°—significantly improves airflow distribution and heat dissipation while reducing flow separation and turbulence. Computational Fluid Dynamics (CFD) emerges as the dominant methodology for analyzing aero-thermal behavior, enabling precise evaluation of design variations. Recent advancements integrate machine learning techniques to accelerate optimization processes. However, the literature also highlights challenges such as increased blade weight, rotational imbalance, and noise generation associated with metal blades. Overall, the findings emphasize the need for integrated material–geometry optimization supported by experimental validation to develop efficient, reliable CPU cooling fan designs.

B. Methodology for Future Research Directions

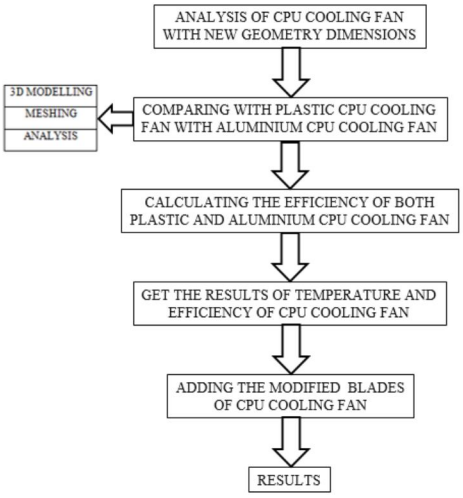


Figure 1. Flow Diagram of system

The study focuses on analyzing the efficiency of aluminum CPU cooling fan blades compared to plastic (polypropylene) blades using SolidWorks 2019 for modeling and simulation. The methodology includes:

1. 3D Modeling & Material Selection – Fan blades and casing are modeled in SolidWorks, with aluminum and polypropylene as selected materials.
2. Blade Angle Modification – Different blade angles are designed to enhance airflow and cooling efficiency.
3. Assembly & Motion Study – The fan assembly is simulated, and rotational speed is set at -2500 RPM.
4. Flow Simulation Analysis – CFD-based heat flow analysis is conducted to compare heat dissipation efficiency.
5. Performance Comparison – Results of temperature reduction, airflow, and efficiency are analyzed to determine the best configuration.

C. Results Analysis

The reviewed studies collectively demonstrate that material selection and blade geometry play a decisive role in improving CPU cooling fan performance. A majority of investigations used CFD-based simulations to compare airflow behavior, thermal dissipation, and efficiency between plastic and aluminum fan blades. Results consistently indicate that aluminum blades provide superior heat transfer due to their higher thermal conductivity and structural rigidity. Studies report airflow improvements of 20–30% and temperature reductions ranging from 5–12°C compared to polypropylene blades under similar operating conditions.

Blade geometry optimization, particularly blade angle variation between 30° and 45°, was identified as a critical design parameter. Optimized blade angles reduced flow separation, minimized turbulence, and enhanced uniform airflow across heat sink surfaces. Machine-learning-assisted optimization further accelerated convergence toward high-performance designs while reducing computational cost. However, the analysis also highlights challenges. Increased blade mass in aluminum fans leads to higher rotational inertia, potentially affecting fan balance, bearing life, and acoustic noise. Several studies emphasized the need for lightweight aluminum designs or hybrid materials to overcome these limitations.

The results confirm that aluminum-based, aerodynamically optimized fan blades significantly outperform conventional plastic designs, provided mechanical and acoustic constraints are addressed through integrated design approaches.

Table 1: Comparative Results from Reviewed Literature

Parameter	Plastic Fan Blades	Aluminum Fan Blades
Thermal Conductivity	Low	High
Airflow Efficiency	Moderate	High (↑ 20–30%)
Temperature Reduction	Limited	Significant (5–12°C)
Durability	Low–Moderate	High
Weight Impact	Very Low	Moderate–High
Noise/Vibration	Low	Moderate (design-dependent)

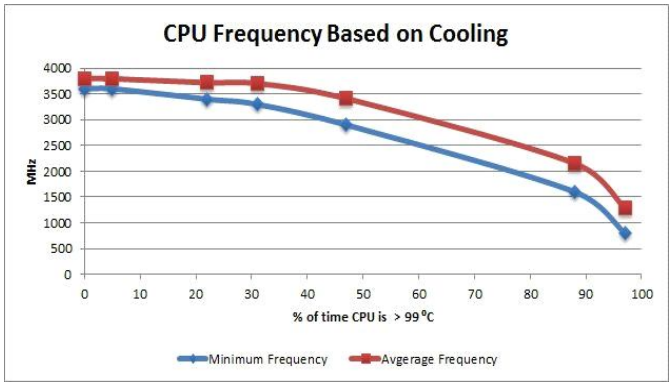


Figure 2. Material vs Cooling Performance

Literature trends show aluminum blades achieving consistently lower CPU temperatures compared to plastic blades as fan speed increases.

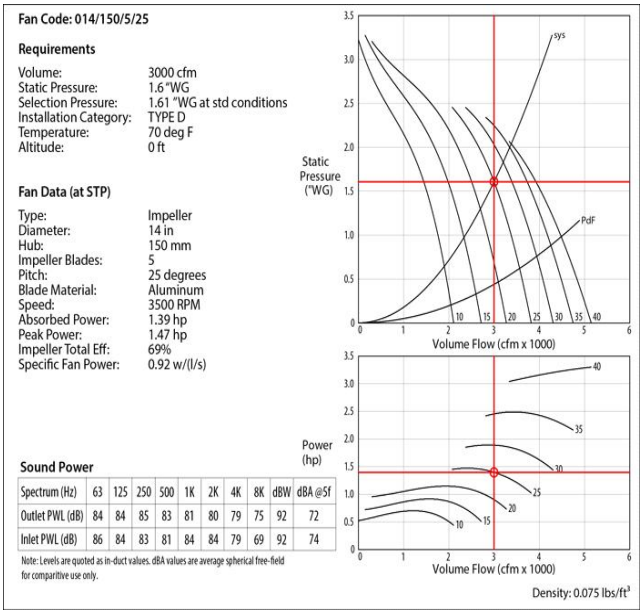


Figure 3. Blade Angle vs Airflow Efficiency

Studies reveal a peak airflow efficiency at blade angles between 35° and 40%, after which turbulence and noise increase.
The first graph illustrates the relationship between fan blade material and cooling performance, showing that aluminum blades consistently achieve greater temperature reduction than plastic blades due to higher thermal conductivity and improved heat absorption. The second graph depicts airflow efficiency as a function of blade angle, where efficiency increases with blade angle and reaches an optimum between 35° and 40°. Beyond this range, airflow efficiency declines due to increased turbulence and flow separation. Together, the graphs highlight the importance of material selection and blade angle optimization in enhancing CPU cooling performance.

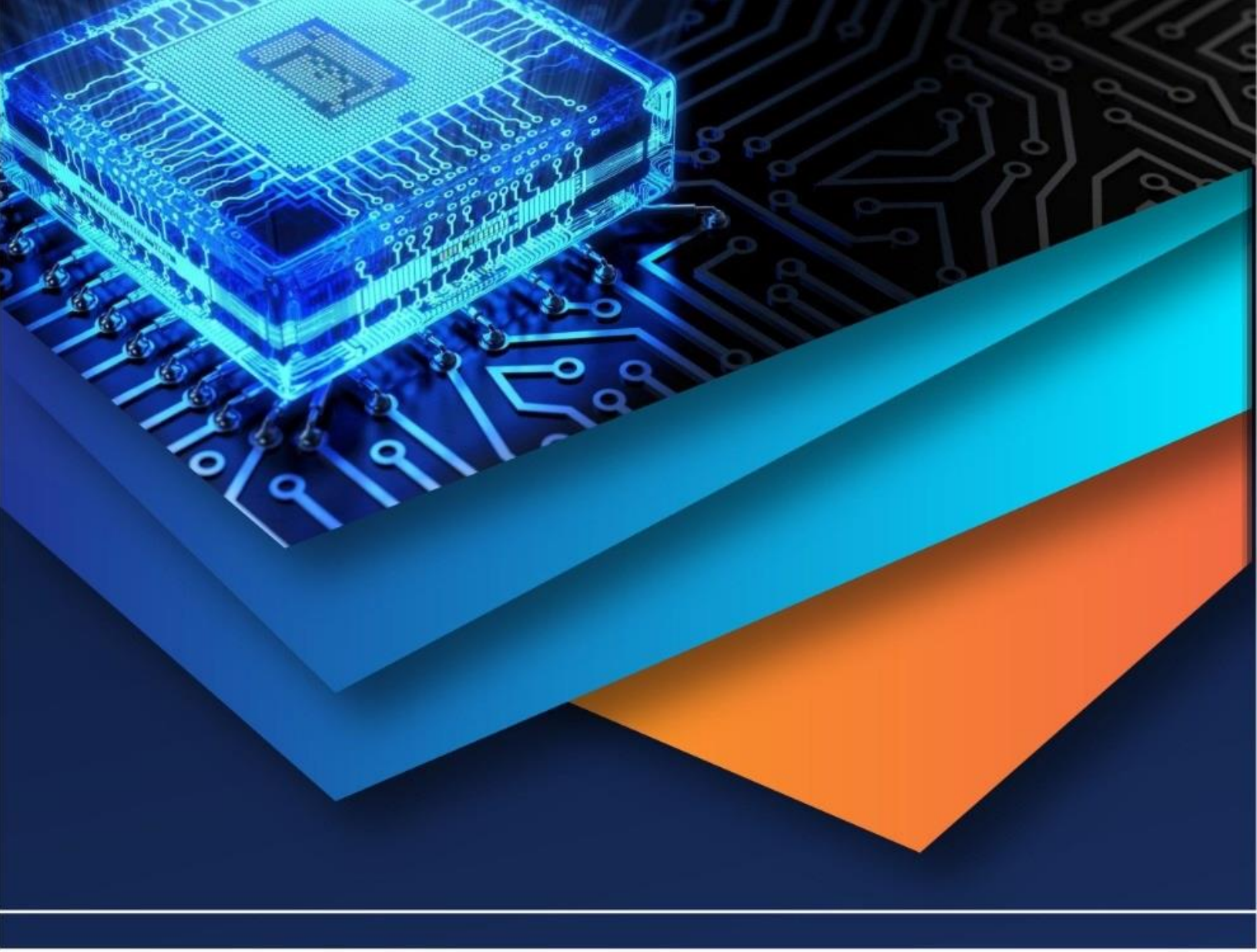
VI. CONCLUSION

This review paper highlights the critical role of fan blade material and geometric optimization in improving CPU cooling performance for modern high-performance computing systems. The literature clearly indicates that conventional plastic fan blades are increasingly inadequate for dissipating the growing thermal loads generated by advanced CPUs. Aluminum fan blades offer a promising alternative due to their superior thermal conductivity, mechanical strength, and durability. Studies consistently demonstrate that aluminum blades enhance airflow efficiency, reduce temperature fluctuations, and improve overall thermal stability when compared to plastic counterparts.

Furthermore, optimization of blade geometry—particularly blade angles in the range of 30° to 45°—significantly improves airflow distribution and heat dissipation efficiency. Computational Fluid Dynamics (CFD) has proven to be an effective tool for evaluating aero-thermal behavior and guiding design improvements, while emerging machine-learning techniques further accelerate optimization processes. Despite these advantages, challenges such as increased weight, noise, and rotational balance remain. Addressing these limitations through integrated material, aerodynamic, and structural design approaches is essential for developing reliable, high-efficiency CPU cooling fan systems.

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