

## Shape Optimization of Header Pipes in Power Plants for Enhanced Efficiency and Environmental Sustainability

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**Abstract :** In a power plant, the header pipe plays a pivotal role in optimizing the performance of diverse systems by serving as a central conduit for the collection and distribution of steam within the plant. This paper investigates the significance of header pipes within power plant setups, highlighting their critical influence on reliability, efficiency, and the performance of the power plant as a whole. The concept of shape optimization emerges as a crucial factor in power plant design and operation, with the potential to maximize performance while minimizing the use of materials. Shape optimization not only enhances efficiency but also contributes to reducing the environmental footprint of power plant installations. In this paper, we initially developed a methodology designed for optimizing header shapes with the primary goal of reducing the usage of costly new alloy materials and lowering the overall maintenance operation expenses. Secondly, we conducted a case study based on an authentic header sourced from an operational power plant.

**Keywords :** shape optimization, header, power plant, inconel alloy, CFD, structural optimization

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