

## 내부 요소 연결 매개법을 이용한 냉각핀의 위상 최적 설계

정영수<sup>†</sup>(서울대) · 김윤영<sup>\*</sup>(서울대)

## The Topology Design Optimization of Cooling Fins Using the Internal Element Connectivity Parameterization Method

Young Soo Joung, Yoon Young Kim

**Key Words:** Topology optimization(위상 최적 설계), Thermal problem(열 문제), Cooling fin(냉각핀), Undershooting(언더슈트), Element Connectivity(요소 연결), Side convection(측면 대류)

**Abstract:** The topology optimization of cooling fins is carried out. Though the topology design method has been successful in structural problems, serious numerical difficulties such as non-physical temperature undershooting have been often observed in its applications to thermal problems. In this investigation, a new method called the element connectivity parameterizing topology optimization method is proposed where all important phenomena such as conduction, surface convection and side convection are taken into account. It was difficult to deal with side convection with conventional approaches. Several cooling fin design problems were considered to show the effectiveness of the proposed method.

## 엔진 냉각시스템 성능예측에 관한 수치해석적 연구

신창훈<sup>†</sup>(한국가스공사) · 이승희<sup>\*</sup>(부산대) · 박원규<sup>\*</sup>(부산대) · 장기룡<sup>\*\*</sup>(현대자동차)

## The Numerical Study about the Performance-Analysis of a Automotive Engine Cooling System

Chang-Hoon Shin, Seung-Hee Lee, Warn-Gyu Park and Gi-lyong Jang

**Key Words :** Engine Cooling System(엔진 냉각 시스템), Thermal Radiation Analysis(방열 해석), Heat Transfer Analysis(열전달 해석), Coolant Flow Analysis(냉각수 유동 해석)

**Abstract :** An engine cooling system affects overall performances of an engine which has been recently requested higher power in more confined engine room. The design of efficient cooling system demands a great effort to effectively correlate with each components, such as water jacket, radiator, coolant pump, cooling fan, etc. Thus, the aim of this study is to provide the design tool of the cooling system in the early design stage by enabling for the designer to accurately predict the engine cooling performances. This user-friendly design tool has various ways to assemble each components and control the running condition with related database. The present design tool was simulated and compared with experimental data. As a result, the inlet and outlet temperature of the radiator agree very well with experiments.