Numerical Method for Fin Profile Optimization

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Abstract : In the present work a numerical method is proposed in order to optimize the thermal performance of finned surfaces. The bidimensional temperature distribution on the longitudinal section of the fin is calculated by restoring to the finite volumes method. The heat flux dissipated by a generic profile fin is compared with the heat flux removed by the rectangular profile fin with the same length and volume. In this study, it is shown that a finite volume method for quadrilaterals unstructured mesh is developed to predict the two dimensional steady-state solutions of conduction equation, in order to determine the sinusoidal parameter values which optimize the fin effectiveness. In this scheme, based on the integration around the polygonal control volume, the derivatives of conduction equation must be converted into closed line integrals using same formulation of the Stokes theorem. The numerical results show good agreement with analytical results. To demonstrate the accuracy of the method, the absolute and root-mean square errors versus the grid size are examined quantitatively.

Keywords : Stokes theorem, unstructured grid, heat transfer, complex geometry, effectiveness

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