ERRATA

Corrections to Author's Closure by D. W. Pepper and R. E. Copper, published in the February 1982 issue of the ASME JOURNAL OF HEAT TRANSFER, pp. 218–219.

Author's Closure

Dr. Beckett's observations on the use of a vector potential in solving three-dimensional flows are well-taken. The formulation of boundary conditions for the vector potential can be troublesome, and is certainly more involved than the constraints imposed when using the primitive equations. It is particularly important that the boundary conditions be well-posed, and care must be taken to properly ensure that the tangential velocities vanish at the surfaces. We agree with Dr. Beckett that ψ must be everywhere solenoidal; likewise, the flow should be divergence free, i.e. $\nabla \cdot \bar{u} = 0$. This condition is not readily guaranteed when using numerical methods, irrespective of the accuracy of the method. Even the use of variational methods (e.g., Lagrangian multipliers) to correct the velocity field is not always satisfactory. However, a good indication of the effectiveness of the numerical solution to obtain a converged solution is to check for divergence. Our computation of the size of $\nabla \cdot \bar{u}$ was obtained by first expressing the velocity components as the gradients of ψ, then computing the gradients of $\bar{u}$. The reason for this is that only ψ and ω values need to be solved in the solution sequence, avoiding the solution of the primitive equations and the troublesome Poisson equation for pressure. Hence, our test for $\nabla \cdot \bar{u}$ (although in terms of ψ) does not necessarily ensure that $\nabla \cdot \psi$ is conserved within the solution domain. It is easy to include a test for $\nabla \cdot \psi$ along with $\nabla \cdot \bar{u}$; testing for $\nabla \cdot \bar{u}$ provides an overall perspective of the solution accuracy of the "numerical" governing equations.