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such as W. With a liquid flowing in large thin-walled tubes, exactly the opposite may occur; the heat capacity of the walls may be negligible in comparison with that of the contained fluid. This would give a corresponding simplification and a greater permissible time interval. In this case the two terms such as H should be combined into an over-all coefficient. The equations are readily written out.

If the apparatus is arranged for parallel or crossflow instead of counterflow, the same formulas are used, solving always for the downstream point of an element and applying the iteration in the appropriate sequence.

Discussion

M. B. Coyle.[3] Professor Dusinberre is to be congratulated on placing yet another tool for the solution of complex heat-flow problems into the hands of the engineer. The latest one is the more valuable in that it deals with problems that are particularly difficult to solve by other methods. He has packed a remarkable amount of information into this short paper, though the important Appendix suffers some loss of clarity in the process. It is, for example, rather alarming at first sight to read that if the value of C is so small that Equation [7] is difficult to satisfy, it may be disregarded, even though further thought shows the advice to be perfectly sound.

The physical interpretation of the formulas (taking the first problem as an example) is presumably that Equations [5] and [11] define two different types of transient, the first taking place as temperature changes in the fluid travel with the fluid down the pipe, and the second arising from thermal lag in the walls. The values of $\Delta\tau$ derived from Equations [7] and [12] give the maximum values of the time interval which permit a detailed study of the corresponding type. The fact that one of these values may be small compared with the other means not that the effect of the corresponding transients will necessarily be small too, but that their duration will be relatively short. Should one type be so rapid that its detailed study is without interest, a "present value" equation like Equation [9] can be used which, while not ignoring the effect of the transients, implies that they occur instantaneously. The use of the small value of $\Delta\tau$ is then unnecessary. This is well shown in the first problem, Table 1, where the air temperatures at $\tau/\Delta\tau = 0$ derived from Equation [9] represent conditions after the sudden change in air temperature has passed down the pipe (which only takes about half a minute) and before the more gradual fall in wall temperature has properly begun.

[3] Metropolitan-Vickers Electrical Co. Limited, Manchester, England.

Author's Closure

This author's failure to use words enough is an old and regrettable habit, so Mr. Coyle's clarification is most welcome. However, to say that Equations [5] and [11] define transients different in type, is less precise than to say that they describe events in different regions of the system under study, these regions being different in physical structure and behavior.

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