Transient Heat Flux Measurement in the Combustion Chamber of a Spark Ignition Engine[1]

A. H. George[2]. Alkidas and Myers reported significant cycle-to-cycle variations in the local surface temperature and local heat flux within the combustion chamber of a spark-ignition engine.

The steady periodic solution of the one-dimensional heat conduction equation [1] was used to compute the local heat flux from measurements of the local surface temperature taken during a particular engine cycle. Unfortunately, this solution to the one-dimensional heat conduction equation is valid only if the local surface temperature time history is a periodic function of time, i.e., only if no cycle-to-cycle variations exist.

The cycle-to-cycle variations in local heat flux reported by Alkidas and Myers may not be meaningful since they are apparently based on an incorrect solution of the one-dimensional heat conduction equation.

Reference

1 Alkidas, A. C., "Heat Transfer Characteristics of a Spark-Ignition Engine," ASME JOURNAL OF HEAT TRANSFER, Vol. 102, No. 1, 1980, pp. 189–193.

Authors' Closure

Professor George's comments on the method used to evaluate cycle-to-cycle variation of local heat flux are valid. The authors are well aware that the technique used is approximate because it assumes that the local surface temperature history is a periodic function of time.

However, the authors are not aware of an "exact" technique that may be used to evaluate heat flux at each cycle. It is also important to note that the cycle-to-cycle variations in heat flux appear to be caused by cycle-to-cycle variations in flame propagation, which are random.

[1] By A. C. Alkidas and J. P. Myers, published in the February 1982 ASME JOURNAL OF HEAT TRANSFER, Vol. 104, No. 1, pp. 62–67.

[2] Division of Engineering, California State University, Chico, Calif. 95929, Assoc. Mem. ASME