Reply by Author to R.A. Spurrier

Allan R. Klumpp*

Jet Propulsion Laboratory, Pasadena, Calif.

THE algorithm suggested by Spurrier offers the advantages claimed and, in addition, reduces execution time. But in the HAL/S language of the space shuttle, Spurrier's algorithm produces an IBM-370 load module 16% longer than the algorithm I suggested. The imprecision of the algorithm I suggested has the effect of halving word length, but only for near-zero quaternion elements. By clever arrangement of equations equivalent to Spurrier's, Shepperd[1,2] has independently produced an algorithm offering the same precision and almost as much speed as Spurrier's, and in addition, the shortest load module of the three. Byte counts for the three HAL/S IBM-370 load modules (with trace option) are Spurrier 750, Klumpp 648, Shepperd 580. All three were coded by the same person, eliminating the programmer variable. Reference 1 presents Shepperd's equations. Reference 2 includes the algorithm.

References

[1] Shepperd, S. W., "Quaternion from Rotation Matrix," *Journal of Guidance and Control*, Vol. 1, May/June 1978, pp. 223-224.

[2] Shepperd, S. W., "Comparison of Two Recommended Quaternion Utility Routines to Current Implementations," Charles Stark Draper Laboratory Shuttle Memo 10E-77-64 TD 4.3, Nov. 1977.