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MAXIMUM-ENTROPY INSPIRED INTERPOLATIVE CLOSURE FOR RADIATIVE HEAT TRANSFER IN GRAY PARTICIPATING MEDIA

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ABSTRACT. A new interpolative-based approximation of the second-order maximum-entropy (M_2) moment closure for predicting radiative heat transfer in gray participating media is proposed and described. In addition to maintaining the desirable properties of the original M_2 closure, the proposed interpolative approximation provides significant reduction in computational costs compared to the expensive numerical solution of the corresponding optimization problem for entropy maximization. Its predictive capabilities are assessed, by considering test problems involving radiative heat transfer within two-dimensional enclosures, the results for which are compared to solutions of the first-order maximum entropy (M_1) moment closure, as well as those of the more commonly adopted spherical harmonics moment closure techniques (first-order P_1 and third-order P_3) and the popular discrete ordinates method (DOM). The latter is used as a benchmark for comparisons, whenever exact solutions are not available. The numerical results show that the solutions of the proposed interpolative M_2 closure are better than those of M_1, P_1 and P_3 for virtually all cases considered.