THE SK_N APPROXIMATION FOR SOLVING RADIATION TRANSPORT PROBLEMS IN ABSORBING, EMITTING, AND SCATTERING RECTANGULAR GEOMETRIES

Zekeriya ALTAÇ
Mesut TEKKALMAZ
Turkish Republic Osmangazi University
School of Engineering and Architecture
Mechanical Engineering Department
Meselik-Eskisehir
TURKEY

ABSTRACT. A high order approximation, the SK_N method-a mnemonic for synthetic kernel-is introduced for solving radiation transfer problems in one and two dimensional geometries. The method relies on approximating the integral transport kernel by a sum of exponential kernels. The integral equation is then reducible to a set of coupled second-order differential equations—SK_N equations. In this study, two types of boundary conditions have been proposed and explored. *Naive* boundary condition assumes one-dimensional slab boundary conditions on each boundary. *Corrected* boundary conditions; tackles the error terms that result from the approximation and is based on the minimization of the error term. The solutions of a test problem —incident radiation, outgoing intensities and heat fluxes at the boundaries--are compared with those of obtained by direct numerical solution of the integral transfer equation. Solutions are obtained for N=2,3,4, and 5 and are in agreement with the direct numerical solutions even for N=2 and 3. The corrected boundary condition gives better solutions than naive boundary condition in optically thin configurations; the relative errors for the intensities are below 1% while 2-4% errors are encountered in the radiation function solutions.