

**CHEBYSHEV COLLOCATION SPECTRAL METHOD FOR SOLVING RADIATIVE  
TRANSFER IN THE 2D ENCLOSURES WITH THE MODIFIED DISCRETE ORDINATE  
FORMULATIONS**

Chen Shangshang<sup>\*</sup>, Li Benwen<sup>\*\*.§</sup>

<sup>\*</sup> Key Laboratory of National Education Ministry for Electromagnetic Processing of Materials,  
Northeastern University, Shenyang 110819, China

<sup>\*\*</sup> Institute of Thermal Engineering, School of Energy and Power Engineering, Dalian University of  
Technology, Dalian 116024, China

<sup>§</sup>Corresponding author. Tel.: +86-13664102228 E-mail: heatli@hotmail.com; heatli@dlut.edu.cn

**ABSTRACT** A Chebyshev collocation spectral method based on modified discrete ordinates method (CSM-MDOM) is developed to solve the radiation transfer problems in 2D enclosure containing the absorbing, emitting and scattering medium. The radiative transfer equation (RTE) is decomposed into two components: the wall-related equation and the medium-related equation. The former one can be solved analytically. For the latter one, the discrete ordinates method is used for angularly discretization and then solved by collocation spectral method. In order to handle the moderate complex geometry (partitioned domain), the domain decomposition technique and the influence matrix technique are used. In this process, with the domain decomposition concept, the partitioned domain of interest is decomposed into rectangular sub-domains. The influence matrix technique is used to ensure the continuity of radiative intensity between the adjacent sub-domain and the CSM-MDOM is used to solve the RTE in each sub-domain. Three test cases are used to validate the accuracy of the developed method. The numerical results confirm that the present method has the capability to handle the partitioned domains and can remedy the nonphysical anomalies caused by the ray effect.