CODES FOR CHAPTER 6

graydifspec.f90, graydifspec.cpp, graydifspec.m

Subroutine `graydifspec` provides the solution to equation (6.23) for an enclosure consisting of N diffusely emitting surfaces with diffuse and specular reflectance components. For each surface the area, emittance, external irradiation and either heat flux or temperature must be specified. In addition, the upper triangle of the view factor matrix must be provided (F^s_{i-j}; $i = 1, N$; $j = i, N$). For closed configurations, the diagonal view factors F^s_{i-i} are not required, since they can be calculated from the summation rule. The remaining view factors are calculated from reciprocity. On output, the program provides all view factors, and temperatures and radiative heat fluxes for all surfaces.

Input:

`N` = number of surfaces in enclosure

`iclsd` = closed or open configuration identifier
`iclsd`= 1: configuration is closed; diagonal F^s_{i-i} evaluated from summation rule
`iclsd`≠ 1: configuration has openings; F^s_{i-i} must be specified

`A(N)` = vector containing surface areas, [m^2]

`EPS(N)` = vector containing surface emittances

`RHOs(N)` = vector containing surface specular reflectance components

`HOs(N)` = vector containing external irradiation, in [W/m^2]

`Fs(N,N)` = vector containing view factors; on input only F^s_{i-j} with $j > i$ (`iclsd`=1) or $j \geq i$ (`iclsd`≠ 1) are required; remainder are calculated

`ID(N)` = vector containing surface identifier:
`ID`=0: surface heat flux is specified, in [W/m^2]
`ID`=1: surface temperature is specified, in [K]

`PIN(N)` = vector containing surface emissive powers (`id`=1) and fluxes (`id`=2)

Output:

`POUT(N)` = vector containing unknown surface fluxes (for surfaces with `id`=1) and emissive powers (for surfaces with `id`=0)

grspecxch.f90, grspecxch.cpp, grspecxch.m

Program `grspecxch` is a front end for subroutine `graydifspec`, generating the necessary input parameters for a three-dimensional variation to Example 6.7 (making the four surfaces of finite length ℓ, and introducing front and back surfaces A_5 and A_6, both diffusely reflecting at the same conditions as the left and right sides, i.e., $T_5 = T_6 = 600$ K and $\epsilon_5 = \epsilon_6 = 0.8$), primarily view factors calculated by calls to function `view`. This program may be used as a starting point for more involved radiative exchange problems.