

Radiation, convection and conduction are the three mechanisms which a zone fire model must consider when calculating the heat transfer between fires, wall surfaces and room gases. Radiation dominates the other two modes of heat transfer in rooms where there are fires or hot smoke layers. The computational requirements of a radiation model can also easily dominate the work required to calculate other physical sub-models in a zone fire model.

This report presents algorithms for efficiently computing the radiative heat exchange between fourwall surfaces, several fires and two interior gases. A two-wall and a ten-wall radiation model are also discussed. The structure of this radiation model is exploited to show that only a few configurations factors need to be calculated directly (two rather than 16 for the four-wall model and eight rather than 100 for the ten-wall model) and matrices needed to solve or the net radiative flux striking each surface are shown, after the appropriate transformation is taken, to be diagonally dominant.

Iterative methods may then be used to solve the linear equations more efficiently than direct methods such as Gaussian elimination.

The radiation exchange algorithms are implemented as FORTRAN subroutines named RAD2, RAD4 and RAD10. These subroutines along with a test driver are available from the author.