

The research goal for the first year of the grant was to determine the best available numerical technology for use in zone fire modeling. The goal for the second year was to incorporate heat conduction into a zone fire model in a numerically robust and efficient manner.

Three prototype zone fire models named MCCFM, CONRAD1 and CONRAD2 were constructed to test the numerical technology use to realize these goals. These zone fire models and their implementations as FORTRAN codes are presented. The code MCCFM, developed during the first year of the grant, demonstrates the advantages of using mass as a solution variable instead of density.

CONRAD1 and CONRAD2 examine two strategies for coupling the heat conduction equation (a one dimensional partial differential equation) with the zone fire modeling ordinary differential equations.

CONRAD1 performs this coupling via the method of lines by using standard piecewise cubic Hermite polynomial basis functions to represent the unknown temperature profiles in the ceiling, wall, and floor heat conduction nodes.

CONRAD2 reduces the heat conduction problem to a set of implicitly defined functional equations, a strategy never before used in zone fire modeling. Both CONRAD1 and CONRAD2 use a differential-algebraic equation solver. Supporting numerical results are presented with timings for a Sun Sparcstation 2.