

This paper describes the model FANRES for predicting transport through a simple fan-resistance ventilation system.

The system consists of a fan and a duct with a single inlet and outlet. The fan characteristics in the range of normal fan operation and the duct resistance are assumed to be known and specified.

Also assumed to be specified are the pressure and density of the environment, and relative elevation local to the two system end-points.

The model predicts the system flow rate for arbitrary end-point conditions and can be used to provide an estimate of flow rate even when end-point environments lead to fan operation in the potentially unstable high-head-pressure region of small-positive-flow and small-back-flow.

While the model described here is useful generally in the simulation of flow dynamics in facilities with simple heating ventilating air conditioning (HVAC) systems, its development was motivated by the need to predict the effects of HVAC systems on compartment fire environments. In particular, the FANRES model was developed for use in zone-type, multi-room compartment fire computer models.

Computer fire models which incorporate solutions to FANRES model equations will be capable of simulating fire conditions in facilities with exhaust systems, pressurization systems, cross-flow ventilation systems, and smoke management systems, for example, in shopping malls or atriums.

An introduction to zone-type fire modeling is provided, and the FANRES model is discussed in detail. The effective flow resistance of a system is required as input to the FANRES model. For methods of estimating this resistance are described in some detail.