Public Abstract
First Name:Shawn
Middle Name:Adam
Last Name:Campbell
Adviser's First Name:Sudarshan
Adviser's Last Name:Loyalka
Co-Adviser's First Name:
Co-Adviser's Last Name:
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Understanding and improved modeling of aerosol evolution in nuclear reactor accidents is important in estimations of the nuclear source term as it is greatly affected by the formation and presence of aerosols in the reactor primary vessel and containment. Current numerical methods such as the widely used sectional technique used by MAEROS in MELCOR and CONTAIN have major inherent approximations which undermine their accuracy and versatility. In this work, the nature of some of the sectional approximations was explored for both single and multi-component aerosols as well as their influence on results. Efforts were then made towards improving the fidelity of the sectional technique to the particle physics by coupling it with a Direct Simulation Monte Carlo (DSMC) method. In addition to this, an alternative, mesh-free method for modeling a non-homogeneous aerosol with DSMC is presented which utilizes a clustering technique. The Partioning Around Medoids (PAM) technique associates particles according to a distance parameter and can be used in place of a mesh for associating neighboring particles for interaction. This cluster method and its application to DSMC are detailed and benchmarked.