TEST PROBLEMS FOR THE VERIFICATION AND VALIDATION OF THE RADIATION, CONDUCTION AND CONVECTION CAPABILITIES OF SYSTEM CODES

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ABSTRACT The purpose of the reactor cavity cooling system in a nuclear plant is to remove the heat released by the reactor pressure vessel effectively. The reactor cavity cooling system must be able to operate naturally or passively safe, particularly in the case of very high temperature reactors, to avoid accidents due to human error or the failure of components. Radiation, convection and conduction heat transfer, as well as natural circulation, are the major natural phenomena that determine the performance of a reactor cavity cooling system. System codes are often used to simulate the operation of a reactor cavity cooling system under various conditions. It is important that the codes should be verified and validated. This is achieved by performing carefully controlled experiments and selecting suitable analytical examples. The experiments and analytical examples are modelled using the codes and simulation results obtained by the codes are then compared with the corresponding experimental and analytical results. This paper is concerned with two test problems for which the analytical solutions can be obtained that can be used to validate the capability of systems codes to model conduction, radiation and convection. The systems codes GAMMA+ and Flownex are employed to demonstrate the application of the test problems.