Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXIII, págs. 2957-2957 (resumen)
Graciela Bertolino, Mariano Cantero, Mario Storti y Federico Teruel (Eds.)
San Carlos de Bariloche, 23-26 Setiembre 2014

MULTIPHASE MODELING OF THE CORE COOLANT CIRCUIT OF A PHWR

Santiago Corzo[a,b], Damian Ramajo[a] and Norberto Nigro[a]

[a]*CIMEC-UNL-CONICET, Colectora ruta 168, paraje el pozo (3000) Santa Fe, Argentina, dramajo@santafe-conicet.gov.ar, nnigro@intec.unl.edu.ar*

[b]*Nuclear Regulatory Authority ARN, Av. Libertador 8250 (C1429BNP) Buenos Aires, Argentina, santiagofcorzo@gmail.com*

Abstract. A multi-dimensional (1/3D) multiphase (liquid-steam) CFD model was developed and employed to simulate the in-core coolant circuit of the Pressure Heavy Water Reactor (PHWR) of Atucha II. The present model has several improvements with respect to a previous 1/3D single-phase model. In this case, a eulerian two-phase model was set for the 3D CFD domains representing the upper and lower plenums and the downcomer. Regarding the channel modeling, additional equations for the steam phase transport, the interphase forces and energy transfer between phases and the steam generation at the channel walls under sub-cooled boiling phenomena were introduced in our in house 1D code. The staggered numerical strategy implemented in the 1D code to solve the 1D equation system in each iteration loop coupling the phase fraction, the pressure-velocity, the energy and the fluid properties were extensively discussed.

The 1D code allowed to find the occurrence of boiling at the end of the most heated coolant channels (central core channels) for a range of reactor powers. Moreover, the 1/3D model allowed to visualize the steam distribution at the upper plenum under a fast power excursion caused by a postulated coolant loss accident.