Public Abstract

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Title:AN EXPERIMENTAL INVESTIGATION OF THE FLUID STRUCTURE INTERACTIONS OF A SINGLE CURVED NUCLEAR FUEL PLATE IN A NARROW CHANNEL

Nuclear research reactors are major scientific tools used by researchers all over the world to produce medical isotopes, irradiated materials, as well as study nuclear processes. Most fuel for research reactors is in the form of plates of uranium clad in aluminum. Forced water flows across the plates for cooling and reaction moderation. The Global Threat Reduction Initiative (GTRI) is an international effort to develop an acceptable low enriched uranium (LEU) fuel to replace the current high enriched uranium (HEU) fuel in research reactors. Because HEU fuel could be used for nuclear weapons, the goal of the GTRI is to prevent proliferation of HEU. The fuel plates and their assemblies must be redesigned using LEU fuel. Also, the LEU assemblies must fit the same profile within the reactors as the HEU assemblies and must provide a similar neutron distribution. The redesigned fuel plates will be thinner and the inter-plate coolant channels will be wider. The fluid structure interaction (FSI) between the fuel plates and coolant needs to be investigated to understand the potential for channel collapse. Channel collapse occurs when plates deflect to the point of touching the neighboring plate significantly cutting off coolant supply. Fluid structure interaction experiments were carried out to validate numerical FSI models that will be used to design structurally stable low enriched uranium fuel plates and assemblies.

Past analysis has been conducted on flat and involute plates in single and multiple plate assemblies with channels of equal thickness. No previous experiments have been carried out on a curved plate with unequal channel gaps.

The fluid structure interaction experiments consist of a thin aluminum plate in a narrow channel. Water flows across the plate, and the deflection of the plate is measured. This experimental analysis shows that curved plates deflect into the larger channel. The experimental deflection results matched well with the numerical FSI models of the experimental setup.