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MODELING THE VIBRATION OF FUEL CHANNELS AND ADJUSTER UNITS IN CANDU REACTORS TO SUPPORT IN-CORE FLUX DETECTOR NOISE ANALYSIS

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ABSTRACT

Surveillance and diagnostic systems are being increasingly used in nuclear power plants to monitor instrument or process condition. Noise analysis of in-core flux detector (ICFD) signals is a technique under development for CANDU as a means of reducing maintenance, inspection, and calibration costs. This technique provides spectral signatures of in-core component vibration.

This paper discusses a program to augment noise analysis by using finite element models of in-core components to identify unknown frequencies in the spectral signatures, and predict the effects of component deterioration. The vibration of fuel channels for Ontario Hydro's Darlington Generating Station were modeled with various end fitting support and garter spring contact. Guide tube and component vibrations for the different length adjuster units were also examined.

These models will help the stations use noise analysis for surveillance (i.e., detecting when something has changed) and for diagnostics (i.e., explaining what the cause and significance of the change is). Furthermore, once the source of the vibrations is determined, these models can be used to assess the diagnostic usefulness of particular vibration peaks. In this way, the sensitivity and reliability of interpreting a given peak in the spectra can be evaluated.

Previously unidentified peaks in ICFD noise spectra and in direct vibration measurements taken in-core have been duplicated under specific support conditions. Guidelines concerning changes in vibration peaks have also been written so that application experts can discern abnormalities in the noise spectra.