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On the rational design of fuel assemblies for reactor facilities from the standpoint of providing vibration strength

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This report deals with a computational and experimental justification for the search of the optimal spacing for the axial fuel assembly (FA) spacer grid (SG) arrangement in reactor facilities subject to vibration resistance requirements. Practically, as is known, the spacing selection is postulated at the present time based on the earlier selected FA dimensions for both effective and decommissioned reactor facilities. However, in our opinion, this selection can be based on results of a computational and experimental justification. The major guidelines for the development of general rules for the rational FA design to ensure reliable operation and vibration resistance of FAs in conditions of impacts from induced hydroelastic vibrations in the axial coolant flow have been formulated with regard for the physical laws of interactions between the flow and elastic structures. A finite element FA model has been built, natural frequencies and modes of bending vibrations have been determined, mathematical relations have been defined to estimate variations in the amplitudes of bending vibrations, and major criteria have been formulated for ensuring the FA vibration resistance. The paper also presents experimentally obtained spectra of the standard multipin FA pressure fluctuations and vibrations in a hydraulic test bench in which water is used as the test environment. Specific recommendations have been developed for the axial FA spacer grid spacing selection.

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