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Seminarium Zakładu Energetyki Jądrowej i Analiz Środowiska (UZ3)
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Gap vortex street formation in the bare rod bundles

Abstract:

Flows in tightly packed rod bundles have been known for a long time to have peculiar patterns, which are not encountered in generic geometries, such as pipes or other simple channels. These patterns, demonstrated by strong, transverse, large-scale motions across the narrow gaps between adjacent fuel elements or between a fuel element and the wall of a containing vessel, enhance drastically the mixing between flows in neighbouring subchannels. This phenomenon is tightly attributed to the Reynold number (Re) and pitch-to-diameter ratio (P/D). However, it is still not possible to predict the occurrence of flow pulsation under given conditions.

In the present study, a wide range of steady and unsteady Reynolds Averaged Navier-Stokes (RANS) computations have been performed to reproduce the occurrence of the gap vortex street in a square bare rod bundle configuration. The considered geometric design is based on a well-known Hooper experiment, which is a bare rod bundle with the P/D ratio of 1.107. The presentation is divided into three main parts. Till now, most of the studies were performed with the use of a cross-sectional domain (sub-region in the vicinity of two adjacent rods) due to the limitations of turbulent models and available computer resources. Thus, in the first part, the influence of the cross-section size domain is assessed. A qualitative and quantitative comparison of the macroscopic flow pulsations (gap instability) generated in the full cross-section domain and cross-sectional domain by means of velocity magnitude, power spectral density and wavelength of the oscillations will be presented. In the second part, an extensive study has been performed to assess the appearance of the gap vortex street in the laminar flow regime. While, in the third part, the influence of the gap width on the axial flow pulsation will be discussed. The obtained results have shown a prominent impact on the flow characteristics, such as wavelength and the dominant frequency of the pulsations.

Serdecznie zapraszamy
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