Analysis of Cross-Flow Induced Vibrations in Staggered Arrangement of Multi-Cylinder System

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Abstract

The interaction of the high velocity fluid flow and structural components can cause self-excited vibrations of the system elements. The induced instability may lead to the maintenance and operational problems of many engineering applications such as water-cooling systems or heat exchangers. The fluid-elastic instability is one of the most important mechanism that can cause vibration damage in the rod bundle system [1, 2].

This work presents a study of the fluid flow and the multi-cylinder system interaction in order to investigate the fluid-elastic instability in the cross-flow using experimental and numerical methods. The rod bundle system consists of circular cylinders placed in the staggered arrangement. The motion of the cylinder, which is a rigid body, has been realized by spring-mass-damper system. The flexibly-mounted cylinder can oscillate in the transverse and longitudinal direction. Numerically the flow induced vibrations have been analyzed with two-dimensional Finite Volume models and have been calculated by the 6 degree-of-freedom solver of the open source software. An experimental set-up was developed. Numerical results have been validated with the experiments.

References

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