NUMERICAL AND EXPERIMENTAL STUDY OF FLUID FLOW IN SIMPLIFIED BLADE CASCADE

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Keywords: *Simplified Blade Cascade, Fluid-Structure Interaction, Discontinuous Galerkin Method, Aeroelasticity, Flutter Boundary*

The main part of this work deal with a comparison of numerical simulation and experimental measurements of compressible viscous fluid flow in simplified blade cascade. The cascade consists of five flat plates three of which perform prescribed harmonic motion. The computed unsteady velocity field is compared with experimental measurements at selected points. Moreover, the power spectral density corresponding to the frequency of harmonic motion is computed for both the numerical and experimental data are compared.

The second part of this work deals with a full fluid-structure interaction problem. The simplified blade cascade from previous experiments was little changed. We consider only four blade profiles, each with a two degrees of freedom. The Isogai [1] wing model was adopted for description of profiles motion. The periodic boundary condition was considered between top and bottom profiles. The several numerical simulations were performed for reconstruction of flutter boundary of blade cascade.

All of the numerical simulation was performed using the developed in-house opensource CFD software FlowPro, which is based on the discontinuous Galerkin method [2, 3]. The FlowPro software is purely written in Java, which makes it easy to use.

REFERENCES

[1] K. Isogai, On the Transonic-Dip Mechanism of Flutter of a Sweptback Wing, *AIAA Journal*, Vol. **17**, pp. 793–795, 1979.

[2] W.H. Reed, T.R. Hill, Triangular mesh methods for the neutron transport equation, *Los Alamos Scientific Laboratory Report*, LA-UR-73-479, 1973.

[3] B. Cockburn, C.-W. Shu, Runge-Kutta Discontinuous Galerkin Methods for Convection-Dominated Problems, *Journal of Scientific Computing*, Vol. **16** (3), pp. 173–261, 2001.