UNSTEADY FLOW SIMULATIONS WITH FREQUENCY DOMAIN METHODS
TRACK 700

CHRISTIAN FREY[*], DANIEL LINDBLAD[†], NIKLAS ANDERSSON[†], GRAHAM ASHCROFT[*]

[*] Institute of Propulsion Technology
German Aerospace Center (DLR), Linder Höhe, 51147 Köln
christian.frey@dlr.de, graham.ashcroft@dlr.de

[†] Department of Mechanics and Maritime Sciences
Chalmers University of Technology, Hörsalsvägen 7A, 41296 Göteborg, Sweden
daniel.lindblad@chalmers.se, niklas.andersson@chalmers.se

Key words: Unsteady Flows, Frequency Domain Methods, Harmonic Balance

ABSTRACT

The problem of simulating time-periodic flows arises in many aeronautical CFD applications. These applications include, but are not limited to, flutter, forced response, and tonal noise predictions. Frequency domain methods, in which the unsteady flow equations are transformed into the frequency domain, is within this context an elegant way to circumvent time-marching the solution towards periodic state via a classical URANS approach. Several frequency domain methods have been proposed over the last three decades: linearized and nonlinear approaches, as well as formulations in both the time- and the frequency domain [1, 2]. Although frequency domain methods are nowadays very successful both in research and industry, many open questions remain, making this topic a continuously active research area. In this minisymposium, we invite scientists to present their work with focus on the improvement of numerical methods. Special emphasis is put on the following topics:

- Efficient and robust solution methods.
- Multiple base frequencies.
- Treatment of turbulence models.
- Nonlinear interactions and applicability of linearization hypotheses.
- Flow instabilities.

Interesting contributions to other aspects of frequency domain methods are, of course, also welcome.

REFERENCES

[1] K. C. Hall, J. P. Thomas, and W. S. Clark. Computation of unsteady nonlinear flows in cascades using a harmonic balance technique. *AIAA J.*, 40(5):879–886, May 2002.

[2] L. He. Fourier methods for turbomachinery applications. *Prog. Aerosp. Sci.*, 46(8):329–341, Nov. 2010.