# Preface

# Special Issue on “BARC benchmark”

The international Benchmark on the Aerodynamics of a Rectangular 5:1 Cylinder (BARC) addresses the high Reynolds number, external, unsteady flow around a stationary, sharp-edged rectangular cylinder, and the associated aerodynamic actions (Bartoli *et al*. 2020). In spite of the simple geometry of the cylinder, BARC is a paradigmatic example of the intricate flows around elongated bodies having a low degree of bluffness, often encountered in Engineering design practice.

BARC has been initially conceived as a double-blind benchmark, i.e., without a-priori selected reference measurements, and open to side-ground parametrical studies around the main setup. Thanks to such an approach, the benchmark attracted the attention of a number of researchers and practitioners adopting both numerical and experimental approaches in several academic and industrial sectors. More than 30 scientific papers on international journals have been devoted to BARC up to now.

The present special issue follows some major milestones of the BARC past activities: the BARC launching on July 2008 at BBAA VI Conference; the BARC website online since 2009, hosted by the Italian Association of Wind Engineering (ANIV), and renewed on June 2020 (www.aniv-iawe.org/barc-home); the overview paper on BARC studies after the first four years of activity published on January 2014 (Bruno *et al*. 2014). Since May 2014 BARC enters as Silver content among the Underlying Flow Regimes (UFR_2-15) in the Knowledge Base Wiki of the European Research Community in Turbulence and Combustion (ERCOFTAC, Bruno & Salvetti, 2017). On February 2021 the BARC-MYOC (Make Your Own Comparison) web application is made available at the BARC website to collect, postprocess and compare the large amount of scientific results obtained so far (Bruno and Mannini 2021).

On the one side, BARC is nowadays a mature test-bench for calibration of WT facilities, validation of CFD codes, training of the new generation of early stage researchers. On the other side, open issues still remain in the understanding and modelling of the BARC main flow, and towards new BARC-related problems.

This special issue aims at gathering researchers from both Fluid Mechanics and Wind Engineering communities, promoting exchanges and complementary approaches between them, crossing the borders of contiguous, but sometimes shamefully apart, disciplinary fields.

Both numerical and experimental approaches are deployed: the special issue collects 13 studies, carried out in equal part by wind tunnel tests and computational simulations. They effectively complement each other with respect to methods and applications. Computational studies span over a rich variety of approaches to turbulence, from DNS (Chiarini and Quadrio, Corsini *et al*.) to LES (Crivellini *et al*. Lunghi *et al*. Sakuma *et al*.) and RANS (Xu *et al*. Ma *et al*. Sakuma *et al*.), and over different numerical approaches. Experimental tests move from classical pressure and force measurements (Cárdenas-Rondón *et al*. Yang *et al*. Wang *et al*. Lei *et al*. Pasqualetto *et al*.) to Particle Image Velocimetry and other anemometric techniques (Guissart *et al*. Pasqualetto *et al*.). Beside the main setup, new problems are proposed and investigated. Among them, let us cite the ‘rounded BARC’ (Chiarini and Quadrio, Lunghi *et al*. Sakuma *et al*.), the ‘porous BARC’ (Xu *et al*.), the ‘gust BARC’ (Cárdenas-Rondón *et al*. Yang *et al*.), the ‘BARC at incidence’ (Guissart *et al*. Cárdenas-Rondón *et al*. Sakuma et a.), the ‘oscillating BARC’ (Wang *et al*. Lei *et al*.). All of them are paradigmatic setups of recurrent problems in wind engineering applications.

BARC is come of age. This special issue is a turning point from past activities to future ones. Good winds to BARC!

## Acknowledgments

The Guest Editors would like to gratefully acknowledge the Authors of the studies collected in the issue, and the colleagues who served as Reviewers.

The BARC benchmark is developed by the Organizing Committee with the support of the Italian National Association for Wind Engineering (ANIV), under the umbrella of the International Association for Wind Engineering (IAWE), in cooperation with the European Research Community On Flow, Turbulence And Combustion (ERCOFTAC).

The BARC web site and web App MYOC has been realized thanks to the support to the BARC dissemination activities offered in 2014 by the Executive Board of IAWE, headed at the time by Prof. Yukio Tamura. The BARC web App MYOC is hosted by Politecnico di Torino.

## References

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