Institut für Hydromechanik (IfH)
Prof. Dr.-Ing. Markus Uhlmann

Institut für Mechanik (IFM)
Prof. Dr.-Ing. Peter Betsch
Prof. Dr.-Ing. Thomas Seelig

Institut für Strömungsmechanik (ISTM)
Prof. Dr.-Ing. Bettina Frohnapfel

Institut für Technische Mechanik (ITM)
Prof. Dr.-Ing. Thomas Böhlke
Prof. Dr.-Ing. Alexander Fidlin
Prof. Dr.-Ing. Carsten Proppe
Prof. Dr.-Ing. Wolfgang Seemann

Kolloquium für Mechanik

Referees:	**Prof. Dr. Nikolai Kornev** Faculty of Mechanical Engineering and Marine Technology, Chair of Modelling and Simulation, University of Rostock
Date:	Thursday, January 16, 2020
Time:	15:45 h
Location:	Building 10.81, Emil Mosonyi-Hörsaal (HS 62, R 153)
Title:	**Generation of Artificial Velocity and Scalar Fluctuations based on Divergence-Free Vortex Particles**

Abstract

Formulation of the inlet condition is a well-recognized problem in LES and DNS simulations. The task is to synthesize a turbulent velocity field V(x ,t) =U(x)+u(x,t), where U(x) is the mean velocity which should be known. The fluctuations u(x,t) need to have a number of properties, which we, according to our experience, list below in the order of their importance:
1). u(x,t) should be spatially and temporally correlated, 2). It needs to have prescribed Reynolds stresses, 3). u(x,t) needs to have prescribed integral lengths, 4) u(x,t) should fulfill the continuity constraint and 5). u(x,t) should have prescribed correlation functions.
The authors have recently improved the turbulent spot methods, originally proposed in [1], by formulation of a new turbulent structure based on strict mathematical derivations [2]. These structures are based on a transformed vector potential from which the velocity field is obtained. The structures are called Vortons. The vortons allow to fulfill the continuity constraint, not only for isotropic Reynolds stresses, but also for arbitrarily anisotropic ones. The behavior of this structure has been tested on spatially decaying turbulence as well as on channel flow. Both case studies confirm that 1) the adaption length is reduced by application of vortons instead of simplicity-motivated velocity distributions like hat spots and 2) by being able to obey continuity always, the artificial pressure noise is greatly reduced.

References:
1. Kornev N , Hassel E. (2007) Synthesis of homogeneous anisotropic divergence-free turbulent fields with prescribed second-order statistics by vortex dipoles. Physics of Fluids, Vol. 19, 5.
2. Kröger H, Kornev N. (2018) Generation of Divergence Free Synthetic Inflow Turbulence with Arbitrary Anisotropy. Computer and Fluids, Vol. 165, 78--88.

Alle Interessenten sind herzlich eingeladen.
Prof. Dr.-Ing. Bettina Frohnapfel