

# Documentation for Research Dataset

## Introduction

This dataset contains velocity data for the following article:

Busse, A. and Zhdanov, O. (2022) Direct numerical simulations of turbulent channel flow over ratchet roughness. *Flow, Turbulence and Combustion* (accepted for publication) (doi: 10.1007/s10494-022-00352-8)

## Surfaces

The geometric definition of the ratchet surfaces and the selected ratchet parameters can be found in the article.

## Velocity statistics

A velocity data file is provided for each surface. The naming convention is as follows: For the windward oriented surfaces, the files are named `VelocityData_1*k_ww.csv` where `*` is replaced by the length of the ratchet in multiples of the ratchet height. For the leeward oriented surfaces, the files are named `VelocityData_1*k_lw.csv` where `*` is replaced by the length of the ratchet in multiples of the ratchet height. Also provided are data for the smooth-wall reference case.

Table 1 gives an overview of the column layout. For the computation of the velocity data intrinsic averaging was applied, i.e., averages are taken over the fluid occupied area only. All velocity data are normalised with the friction velocity  $u_\tau$  which is based on the constant mean streamwise pressure gradient and the mean channel half-height.

Table 1 Column layout for velocity statistics files

Column	Contents	Comments
1	$z/\delta$	Wall-normal location
2	$\langle \bar{u} \rangle$	Mean velocity
3	$\langle \overline{u'u'} \rangle$	Streamwise normal Reynolds stress
4	$\langle \overline{v'v'} \rangle$	Spanwise normal Reynolds stress
5	$\langle \overline{w'w'} \rangle$	Wall-normal Reynolds stress
6	$\langle \overline{u'w'} \rangle$	Reynolds shear stress
7	$\langle \tilde{u}\tilde{u} \rangle$	Streamwise dispersive stress ( <i>not applicable for smooth-wall case</i> )
8	$\langle \tilde{w}\tilde{w} \rangle$	Wall-normal dispersive stress ( <i>not applicable for smooth-wall case</i> )
9	$\langle \tilde{u}\tilde{w} \rangle$	Dispersive shear stress ( <i>not applicable for smooth-wall case</i> )

## Further information

In case of questions about this dataset, please contact the authors.