Impact of spanwise effective slope on rough-wall turbulent channel flow — dataset

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Surface and velocity data discussed in the paper

> [1] Thomas O. Jelly, Aditya Ramani, Bagus Nugroho, Nicholas Hutchins and Angela Busse, *Impact of spanwise effective slope on rough-wall turbulent channel flow*, Journal of Fluid Mechanics, (accepted in September 2022)

is made available to the public. The reader is referred to [1] for a fully detailed description of the dataset and the methods used for its generation.

Contents of the database

The database contains representations of ten near-Gaussian surfaces with varying spanwise effective slope (ES_y) and streamwise effective slope (ES_x) at a friction Reynolds number $Re_\tau = 395$, as well as reference smooth-wall data at matched flow conditions. Each surface is named using the following identification code:

$$\underbrace{010}_{ES_x}\text{\_}\underbrace{035}_{ES_y} \tag{1}$$

where the first three digits represent the value of the streamwise effective slope, e.g. $ES_x = 0.10$, and the last three three digits represent the value of the of the spanwise effective slope, e.g. $ES_x = 0.35$. Decimal points have been omitted for brevity. In addition, velocity statistics (mean streamwise velocity profiles, Reynolds and dispersive stress statistics) are included in this dataset.

Surfaces

All coordinates and heights are given in units of the mean channel half-height δ as described in the paper [1].

The surface has a domain size in the streamwise and spanwise direction of $(8\delta \times 4\delta)$ and are given in the form of a `.csv` file. The following naming convention is applied: `heightmap_*.csv` where `*` is replaced by the a surface identification code, e.g., the data corresponding to $ES_x = 0.10$ and $ES_y = 0.35$ is contained in `heightmap_010_035.csv`. The first column contains the streamwise coordinate x_1 and the second column the spanwise coordinate x_2 on the surface. The third column contains the height of the surface at the corresponding location (x_1, x_2).

column	1	2	3	4	5	6	7
contents	z^+	z/δ	$\langle \overline{u}_1 \rangle^+$	$\langle \overline{u_1'^+ u_1'^+} \rangle$	$\langle \overline{u_2'^+ u_2'^+} \rangle$	$\langle \overline{u_3'^+ u_3'^+} \rangle$	$\langle \overline{u_1'^+ u_3'^+} \rangle$
column				8	9	10	11
contents				$\langle \tilde{u}_1^+ \tilde{u}_1^+ \rangle$	$\langle \tilde{u}_2^+ \tilde{u}_2^+ \rangle$	$\langle \tilde{u}_3^+ \tilde{u}_3^+ \rangle$	$\langle \tilde{u}_1^+ \tilde{u}_3^+ \rangle$

Table 1: Column layout of `vel_profiles_*.csv` files.

Mean streamwise velocity profiles, Reynolds and dispersive stress statistics

For each surface a `.csv` is given that contains the mean velocity profile and Reynolds and dispersive stress statistics. The following naming convention is applied: `vel_profiles_*.csv` where `*` is replaced by a surface identification code, e.g., the data corresponding to $ES_x = 0.10$ and $ES_y = 0.35$ is contained in `vel_profiles_010_035.csv`. The column layout is given in table 1. A file named `vel_profiles_ref_*.csv` contains the corresponding data for the smooth-wall reference case using the same column layout excluding columns 8 to 11 as dispersive stresses are not defined for the smooth-wall case.