Reynolds and dispersive shear stress contributions above highly skewed roughness - dataset

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Surface and velocity data discussed in the paper

> [1] Thomas O. Jelly and Angela Busse, *Reynolds and dispersive shear stress contributions above highly skewed roughness*, Journal of Fluid Mechanics (accepted in June 2018)

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 the three surfaces studied named 'Gaussian', 'peaks', and 'pits' in the paper. In addition, velocity statistics (roughness function contributions, mean streamwise velocity profiles, and quadrant statistics) are included in this dataset.

Surfaces

The height of the surfaces are given in the form of a `.csv` file named `heightmap.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 Gaussian surface at the corresponding location (x_1, x_2), the fourth column the height of the 'peaks' surface, and the fifth column the height of the 'pits' surface. All coordinates and heights in this file are given in units of the mean channel half-height δ as described in the paper [1].

Roughness function ΔU^+

The file named `Figure2.csv` contains the data shown in Figure 2 of the paper. The first column contains x_3/δ, the wall-normal coordinate normalised with the mean channel half-height δ. The second, third, and fourth columns contain the difference of the mean streamwise velocity profile of the rough-wall case to the smooth wall-reference case $\Delta U^+(x_3/\delta)$ at the wall-normal location given in the first column. The second column gives the data for the

'Gaussian', the third column for the 'peaks', and the fourth column for the 'pits' surface. The three remaining columns give the values for $\Delta U^+(x_3/\delta)$ computed from the roughness function equation (see equation 3.2 in the paper). The fifth column gives the data for the 'Gaussian', the sixth column for the 'peaks', and the seventh column for the 'pits' surface. Please note that this equation only applies above the highest peak of each the surface. Therefore no values can be given for the 'Gaussian' and the 'peaks' surface below $x_3/\delta = 0.12$; in the file corresponding ΔU^+ entries for $x_3/\delta < 0.12$ are set to zero for the 'Gaussian' and the 'peaks' surface.

The file named `Figure3.csv` contains the data shown in Figure 3 of the paper. For each of the three rough surfaces, the total roughness function $\Delta U^+(\delta^+)$ and the different contributions to the total roughness functions are given.

Mean streamwise velocity profiles

The files named `Figure5a_1.csv` and `Figure5a_2.csv` contain the data shown in Figure 5(a) of the paper. `Figure5a_1` contains the mean streamwise velocity profiles for the rough-wall cases. The first column contains the wall-normal position x_3^+ and columns 2 to 4 the corresponding values of the mean streamwise velocity $\langle \overline{u}_1^+ \rangle$ in the order 'Gaussian' (column 2), 'peaks' (column 3), and 'pits' (column 4). `Figure5a_2` contains the mean streamwise velocity profiles for the smooth-wall case. The first column contains the wall-normal position x_3^+ and column 2 the corresponding value of the mean streamwise velocity $\langle \overline{u}_1^+ \rangle$.

Dispersive shear stress

The file named `Figure5b.csv` contains the dispersive shear stress shown in Figure 5(b) of the paper. The first column contains the wall-normal position x_3^+ and columns 2 to 4 the corresponding values of the dispersive shear stress $-\left\langle \tilde{u}_1^+ \tilde{u}_3^+ \right\rangle$ in the order 'Gaussian' (column 2), 'peaks' (column 3), and 'pits' (column 4).

Reynolds shear stress difference

The file named `Figure5c.csv` contains the Reynolds shear stress difference shown in Figure 5(c) of the paper. The first column contains the wall-normal position x_3^+ and columns 2 to 4 the corresponding values of the Reynolds shear stress difference $\Delta \left\langle \overline{u_1' u_3'}^+ \right\rangle$ in the order 'Gaussian' (column 2), 'peaks' (column 3), and 'pits' (column 4).

Quadrant statistics of dispersive shear stress

The files named `Figure6[a-b].csv` contain the contributions of the different quadrants of the dispersive shear stress in the following format: The first column contains the wall-normal position x_3/δ, columns 2 to 5 the contributions of the different quadrants to the dispersive shear stress (in '+' units) in numerical order. Column 6 contains the sum of the four quadrant contributions. File `Figure6a.csv` gives the dispersive shear stress quadrant statistics for the 'Gaussian' surface, `Figure6b.csv` for the 'peaks' surface, and `Figure6c.csv` for the 'pits' surface.

Quandrant statistics of Reynolds shear stress difference

The files named `Figure7[a-b].csv` contain the contributions of the different quadrants of the Reynolds shear stress difference in the following format: The first column contains the wall-normal position x_3/δ, columns 2 to 5 the contributions of the different quadrants to the Reynolds shear stress difference (in '+' units) in numerical order. Column 6 contains the sum of the four quadrant contributions. File `Figure7a.csv` gives the Reynolds shear stress difference quadrant statistics for the 'Gaussian' surface, `Figure7b.csv` for the 'peaks' surface, and `Figure7c.csv` for the 'pits' surface.