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ReadMe Author: Thomas Preskett, University of Southampton

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This dataset supports the publication:

AUTHORS: T. Preskett, M. Virgillo, P. Jaiswal and B. Ganapathisubramani

TITLE: Effects of pressure gradient histories on skin friction and mean flow of high Reynolds number turbulent boundary layers over smooth and rough walls

JOURNAL: JFM

PAPER DOI IF KNOWN:

Links to other publicly accessible locations of the data:

Links/relationships to ancillary or related data sets:

DATA & FILE OVERVIEW

RW is used for rough wall data and SW for smooth wall data. The h value is the height of the quarter chord above the floor as shown in figure 1. The filenames contain both the surface, velocity, angle of attack and the height above the floor.

This dataset contains the following folders and files:

Mean_Cp_Data_SW – Contains both the mean Cp and dCp/d(x/c), averaged across all speeds, along with the position of each tap relative to the leading edge of the aerofoil at 6.53m for the smooth wall.

Mean_Cp_Data_RW – Contains both the mean Cp and dCp/d(x/c), averaged across all speeds, along with the position of each tap relative to the leading edge of the aerofoil at 6.53m for the rough wall.

Cp_Data_SW – Contains both the Cp and dCp/d(x/c) at -8˚ and 8˚ at 10, 20 and 30 m/s along with the position of each tap relative to the leading edge of the aerofoil at 6.53m for the smooth wall.

Upstream_Velocity_Profiles_RW – Contains the upstream boundary layer at 10, 15, 20, 25 and 30 m/s for -8˚ and 8˚. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m) and U_{99} (m/s).

Upstream_Velocity_Profiles_SW – Contains the upstream boundary layer at 10, 20 and 30 m/s for -8˚ and 8˚. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m) and U_{99} (m/s).

Downstream_Velocity_Profiles_ZPG_RW – Contains the ZPG rough wall boundary layer profile measured at 9.03m from the start of the test section. Velocities presented are 15, 20, 25 and 30 m/s. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m), U_{99} (m/s), Uτ (m/s), v (m/s), Cf, θ (m), δ* (m), d (m), y_0 (m), Π, Reτ, Re_L.

Downstream_Velocity_Profiles_RW_h_0.5m– Contains the rough wall boundary layer profile measured at 9.03m from the start of the test section. There are 5 angles of attacks at h = 0.5 m for 10-30 m/s in steps of 5 m/s. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m), U_{99} (m/s), Uτ (m/s), v (m/s), Cf, θ (m), δ* (m), d (m), y_0 (m), Π, Reτ, Re_L.

Downstream_Velocity_Profiles_SW_h_0.5m– Contains the smooth wall boundary layer profile measured at 9.03m from the start of the test section. There are 5 angles of attacks at h = 0.5 m

for 10-30 m/s in steps of 10 m/s. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m), U_{99} (m/s), Uτ (m/s), v (m/s), Cf, θ (m), δ* (m), d (m), y_0 (m), Π, Reτ, Re_L.

Downstream_Velocity_Profiles_RW_h_0.4m– Contains the rough wall boundary layer profile measured at 9.03m from the start of the test section. There are 3 angles of attacks at h = 0.4 m for 20-30 m/s in steps of 5 m/s. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m), U_{99} (m/s), Uτ (m/s), v (m/s), Cf, θ (m), δ* (m), d (m), y_0 (m), Π, Reτ, Re_L.

Downstream_Velocity_Profiles_SW_h_0.4m– Contains the smooth wall boundary layer profile measured at 9.03m from the start of the test section. There are 2 angles of attacks at h = 0.4 m for 10-30 m/s in steps of 10 m/s. Each file contains the velocity profile y (m) vs U (m/s) along with the δ (m), U_{99} (m/s), Uτ (m/s), v (m/s), Cf, θ (m), δ* (m), d (m), y_0 (m), Π, Reτ, Re_L.

Datasets for each figure within the paper described above:

Fig 2:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m contained in dCpdxc_SW_h_0.5m.csv file in Mean_Cp_Data_SW
- -8˚, -10˚at h = 0.4m contained in dCpdxc_SW_h_0.4m.csv file in Mean_Cp_Data_SW

RW Data Sets -

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m contained in dCpdxc_RW_h_0.5m.csv file in Mean_Cp_Data_RW
- -4˚, -8˚, -10˚at h = 0.4m contained in dCpdxc_RW_h_0.4m.csv file in Mean_Cp_Data_RW

Fig 3:

SW Data Sets –

- -8˚and 8˚ at h = 0.5m at 30 m/s contained within Upstream_Velocity_Profiles_SW, filename in the format - Upstream_SW_Vel_30_AOA_-8_h_0.5m.csv, change angle of attack as needed

RW Data Sets –

- -8˚and 8˚ at h = 0.5m at 10 m/s contained within Upstream_Velocity_Profiles_RW, filename in the format - Upstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed

Fig 4a:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_30_AOA_-8_h_0.5m.csv, change angle of attack as needed

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed

Fig 4b:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 20 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚and -4˚ at h = 0.4m at 20 m/s contained within Downstream_Velocity_Profiles_SW_h_0.4m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 20 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_20_ZPG.csv

Fig 5a:

SW Data Sets –

- -8˚, 0˚ and 8˚ at h = 0.5m at 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_30_AOA_-8_h_0.5m.csv, change angle of attack as needed

RW Data Sets –

- -8˚, 0˚ and 8˚ at h = 0.5m at 10 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed

Fig 5b:

RW Data Sets –

- -8˚at h = 0.5m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed

Fig 6a:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚ and -8˚at h = 0.4m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.4m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed
- ZPG from https://doi.org/10.4121/22ade4b5-9b45-40a1-b526-a91f4c2a0336

Fig 6b:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 15, 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 10, 15, 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 15, 20, 25 and 30 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_10_ZPG.csv vary speed as required

Fig 7a:

SW Data Sets –

- -8˚, 0˚ and 8˚ at h = 0.5m at 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_30_AOA_-8_h_0.5m.csv, change angle of attack as needed

RW Data Sets –

- -8˚, 0˚ and 8˚ at h = 0.5m at 10 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed

Fig 7b:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚ and -8˚at h = 0.4m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.4m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed
- ZPG at 10, 20 and 30 m/s from https://doi.org/10.4121/22ade4b5-9b45-40a1-b526-a91f4c2a0336

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 15, 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 15, 20, 25 and 30 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_10_ZPG.csv vary speed as required

Fig 8a:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 15, 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_15_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 15, 20, 25 and 30 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_15_ZPG.csv vary speed as required

Fig 8b:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 20 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_20_ZPG.csv vary speed as required

Fig 9:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 20 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_20_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚ and -8˚at h = 0.4m at 20 m/s contained within Downstream_Velocity_Profiles_SW_h_0.4m, filename in the format - Downstream_SW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- ZPG at 20m/s from https://doi.org/10.4121/22ade4b5-9b45-40a1-b526-a91f4c2a0336

Fig 10a:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚at h = 0.4m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 20 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_20_ZPG.csv vary speed as required

Fig 10b:

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 20 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_20_AOA_-8_h_0.4m.csv, change angle of attack as needed
- 20 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_20_ZPG.csv vary speed as required

Fig 11a:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m contained in Cp_SW_h_0.5m.csv file in Mean_Cp_Data_SW
- -8˚, -10˚at h = 0.4m contained in dCpdxc_SW_h_0.4m.csv file in Mean_Cp_Data_SW

RW Data Sets -

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m contained in Cp_RW_h_0.5m.csv file in Mean_Cp_Data_RW
- -4˚, -8˚, -10˚at h = 0.4m contained in Cp_RW_h_0.4m.csv file in Mean_Cp_Data_RW

Fig 11b:

SW Data Sets –

- -8 and 8˚ at h = 0.5m contained in dCpdxc_SW_AOA_-8_h_0.5m.csv file in Cp_Data_SW, change angle of attack as required.

Fig 13a and b:

SW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.5m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚ and -8˚at h = 0.4m at 10, 20 and 30 m/s contained within Downstream_Velocity_Profiles_SW_h_0.4m, filename in the format - Downstream_SW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed
- ZPG at 10, 20 and 30 m/s from https://doi.org/10.4121/22ade4b5-9b45-40a1-b526-a91f4c2a0336

RW Data Sets –

- -8˚, -4˚, 0˚, 4˚ and 8˚ at h = 0.5m at 10, 15, 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.5m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.5m.csv, change angle of attack as needed
- -10˚, -8˚ and -4˚ at h = 0.4m at 20, 25 and 30 m/s contained within Downstream_Velocity_Profiles_RW_h_0.4m, filename in the format - Downstream_RW_Vel_10_AOA_-8_h_0.4m.csv, change angle of attack as needed

- 15, 20, 25 and 30 m/s ZPG RW data contained with Downstream_Velocity_Profiles_ZPG_RW named Downstream_RW_Vel_10_ZPG.csv vary speed as required