SUBMERGED VANES TURBULENCE
EXPERIMENTAL ANALYSIS

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
PhD. In Civil Engineering

Supervised by:

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GRUP D’INVESTIGACIO EN MODELITZACIO DE CONQUES I
TRANSPORT DE SEDIMENTS

Funded by:

June 2015
APPENDIX D.

RESULTS – SUBMERGED VANES ADVANCED TURBULENCE
Appendix D Results – Submerged Vanes Advanced Turbulence

D.1 Kinetic Energy Spectrum

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = -25$-cm, $y = -25$, $z = 1$-cm (left – Probe 0) and $x = 15$-cm, $y = -15$, $z = 1$-cm (right – Probe 1).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 25$-cm, $y = -5$, $z = 1$-cm (left – Probe 2) and $x = 35$-cm, $y = 0$, $z = 1$-cm (right – Probe 3).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov's universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = 45$-cm, $y = 15$, $z = 1$-cm (left – Probe 4) and $x = 55$-cm, $y = 25$, $z = 1$-cm (right – Probe 5).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = 60$-cm, $y = 34$, $z = 1$-cm (left – Probe 6) and $x = -25$-cm, $y = -25$, $z = 2$-cm (right – Probe 0).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = 15$-cm, $y = -15$, $z = 2$-cm (left – Probe 1) and $x = 25$-cm, $y = -5$, $z = 2$-cm (right – Probe 2).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 35$-cm, $y = 0$, $z = 2$-cm (left – Probe 3) and $x = 45$-cm, $y = 15$, $z = 2$-cm (left – Probe 4).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 55$-cm, $y = 25$, $z = 2$-cm (left – Probe 5) and $x = 60$-cm, $y = 34$, $z = 2$-cm (right – Probe 6).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = -25$-cm, $y = -25$, $z = 3$-cm (left – Probe 0) and $x = 15$-cm, $y = -15$, $z = 3$-cm (right – Probe 1).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 25$-cm, $y = -5$, $z = 3$-cm (left – Probe 2) and $x = 35$-cm, $y = 0$, $z = 3$-cm (right – Probe 3).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 45$-cm, $y = 15$, $z = 3$-cm (left – Probe 4) and $x = 55$-cm, $y = 25$, $z = 3$-cm (right – Probe 5).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 60$-cm, $y = 34$, $z = 3$-cm (left – Probe 6) and $x = -25$-cm, $y = -25$, $z = 4$-cm (right – Probe 0).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 15$-cm, $y = -15$, $z = 4$-cm (left – Probe 1) and $x = 25$-cm, $y = -5$, $z = 4$-cm (right – Probe 2).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 35$-cm, $y = 0$, $z = 4$-cm (left – Probe 3) and $x = 45$-cm, $y = 15$, $z = 4$-cm (left – Probe 4).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 55$-cm, $y = 25$, $z = 4$-cm (left – Probe 5) and $x = 60$-cm, $y = 34$, $z = 4$-cm (right – Probe 6).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = -25$-cm, $y = -25$, $z = 5$-cm (left – Probe 0) and $x = 15$-cm, $y = -15$, $z = 5$-cm (right – Probe 1).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 25$-cm, $y = -5$, $z = 5$-cm (left – Probe 2) and $x = 35$-cm, $y = 0$, $z = 5$-cm (right – Probe 3).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 45$-cm, $y = 15$, $z = 5$-cm (left – Probe 4) and $x = 55$-cm, $y = 25$, $z = 5$-cm (right – Probe 5).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 60$-cm, $y = 34$, $z = 5$-cm (left – Probe 6) and $x = -25$-cm, $y = -25$, $z = 6$-cm (right – Probe 0).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 15$-cm, $y = -15$, $z = 6$-cm (left – Probe 1) and $x = 25$-cm, $y = -5$, $z = 6$-cm (right – Probe 2).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $(-5/3)$ theorem, at points: $x = 35$-cm, $y = 0$, $z = 6$-cm (left – Probe 3) and $x = 45$-cm, $y = 15$, $z = 6$-cm (left – Probe 4).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = 55\text{-}cm, y = 25, z = 6\text{-}cm$ (left – Probe 5) and $x = 60\text{-}cm, y = 34, z = 6\text{-}cm$ (right – Probe 6).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = -25\text{-}cm, y = -25, z = 7\text{-}cm$ (left – Probe 0) and $x = 15\text{-}cm, y = -15, z = 7\text{-}cm$ (right – Probe 1).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left( -\frac{5}{3} \right)$ theorem, at points: $x = 25\text{-}cm, y = -5, z = 7\text{-}cm$ (left – Probe 2) and $x = 35\text{-}cm, y = 0, z = 7\text{-}cm$ (right – Probe 3).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left(- \frac{5}{3}\right)$ theorem,

at points: $x = 45$-cm, $y = 15$, $z = 7$-cm (left – Probe 4) and $x = 55$-cm, $y = 25$, $z = 7$-cm (right – Probe 5).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left(- \frac{5}{3}\right)$ theorem,

at points: $x = 60$-cm, $y = 34$, $z = 7$-cm (left – Probe 6) and $x = -25$-cm, $y = -25$, $z = 8$-cm (right – Probe 0).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left(- \frac{5}{3}\right)$ theorem,

at points: $x = 15$-cm, $y = -15$, $z = 8$-cm (left – Probe 1) and $x = 25$-cm, $y = -5$, $z = 8$-cm (right – Probe 2).
Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left(-\frac{5}{3}\right)$ theorem, at points: $x = 35$-cm, $y = 0$, $z = 8$-cm (left – Probe 3) and $x = 45$-cm, $y = 15$, $z = 8$-cm (left – Probe 4).

Energy spectrum $E(k)$ versus frequency compared with Kolmogorov’s universal equilibrium $\left(-\frac{5}{3}\right)$ theorem, at points: $x = 55$-cm, $y = 25$, $z = 8$-cm (lift – Probe 5) and $x = 60$-cm, $y = 34$, $z = 8$-cm (right – Probe 6).
D.2 Turbulent Velocities Fields

Turbulent velocities fields at point (x = -25-cm, y = -25, z = 1-cm), each dot represents a pair at a certain time:
(blue) $v'_x, v'_z$, (green) $v'_y, v'_z$ and (red) $v'_y, v'_z$ – upstream of vane – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 1-cm), each dot represents a pair at a certain time:
(blue) $v'_x, v'_y$, (green) $v'_y, v'_z$ and (red) $v'_y, v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 25-cm, y = -5, z = 1-cm), each dot represents a pair at a certain time:
(blue) $v'_x, v'_y$, (green) $v'_y, v'_z$ and (red) $v'_y, v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point \( (x = 35\text{-cm}, y = 0, z = 1\text{-cm}) \), each dot represents a pair at a certain time:

- (blue) \( v'_x, v'_y, v'_z \)
- (green) \( v'_x, v'_y \)
- (red) \( v'_y, v'_z \) — downstream of vane — Experimental results.

Turbulent velocities fields at point \( (x = 45\text{-cm}, y = 15, z = 1\text{-cm}) \), each dot represents a pair at a certain time:

- (blue) \( v'_x, v'_y, v'_z \)
- (green) \( v'_x, v'_z \)
- (red) \( v'_y, v'_z \) — downstream of vane — Experimental results.

Turbulent velocities fields at point \( (x = 55\text{-cm}, y = 25, z = 1\text{-cm}) \), each dot represents a pair at a certain time:

- (blue) \( v'_x, v'_y, v'_z \)
- (green) \( v'_x, v'_z \)
- (red) \( v'_y, v'_z \) — downstream of vane — Experimental results.
Turbulent velocities fields at point (x = 60-cm, y = 34, z = 1-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = -25-cm, y = -25, z = 2-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – upstream of vane – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 2-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 25-cm, y = -5 cm, z = 2-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, v'_z \), (green) \( v'_x, v'_y \) and (red) \( v'_x, v'_z \) – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 35-cm, y = 0, z = 2-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, v'_z \), (green) \( v'_x, v'_y \) and (red) \( v'_x, v'_z \) – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 45-cm, y = 15, z = 2-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, v'_z \), (green) \( v'_x, v'_y \) and (red) \( v'_x, v'_z \) – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 55-cm, y = 25, z = 2-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_x$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 60-cm, y = 34, z = 2-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_x$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = -25-cm, y = -25, z = 3-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_y$, $v'_z$ – upstream of vane – Experimental results.
Turbulent velocities fields at point (x = 15-cm, y = -15, z = 3-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_4$ and (red) $v'_5$, $v'_6$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 25-cm, y = -5, z = 3-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_4$ and (red) $v'_5$, $v'_6$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 35-cm, y = 0, z = 3-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_4$ and (red) $v'_5$, $v'_6$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 45-cm, y = 15, z = 3-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, \) (green) \( v'_x, v'_z \) and (red) \( v'_y, v'_z \) – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 55-cm, y = 25, z = 3-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, \) (green) \( v'_x, v'_z \) and (red) \( v'_y, v'_z \) – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 60-cm, y = 34, z = 3-cm), each dot represents a pair at a certain time:
(blue) \( v'_x, v'_y, \) (green) \( v'_x, v'_z \) and (red) \( v'_y, v'_z \) – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = -25-cm, y = -25, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – upstream – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 25-cm, y = -5, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 35-cm, y = 0, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 45-cm, y = 15, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 55-cm, y = 25, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 60-cm, y = 34, z = 4-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_x$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = -25-cm, y = -25, z = 5-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_x$ and (red) $v'_y$, $v'_z$ – upstream of vane – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 5-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, $v'_x$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 25-cm, y = -5, z = 5-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_x$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 35-cm, y = 0, z = 5-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_x$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 45-cm, y = 15, z = 5-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_x$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point \((x = 55\text{-cm}, y = 25, z = 5\text{-cm})\), each dot represents a pair at a certain time:
(blue) \(v'_x, v'_y\), (green) \(v'_x, v'_z\) and (red) \(v'_y, v'_z\) – downstream of vane – Experimental results.

Turbulent velocities fields at point \((x = 60\text{-cm}, y = 34, z = 5\text{-cm})\), each dot represents a pair at a certain time:
(blue) \(v'_x, v'_y\), (green) \(v'_x, v'_z\) and (red) \(v'_y, v'_z\) – downstream of vane – Experimental results.

Turbulent velocities fields at point \((x = -25\text{-cm}, y = -25, z = 6\text{-cm})\), each dot represents a pair at a certain time:
(blue) \(v'_x, v'_y\), (green) \(v'_x, v'_z\) and (red) \(v'_y, v'_z\) – upstream of vane – Experimental results.
Turbulent velocities fields at point (x = 15-cm, y = -15, z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 25-cm, y = -5 z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 35-cm, y = 0, z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 45-cm, y = 15, z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 55-cm, y = 25, z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 60-cm, y = 34, z = 6-cm), each dot represents a pair at a certain time: (blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = -25-cm, y = -25, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – upstream of vane – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 25-cm, y = -5, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_x$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 35-cm, y = 0, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v_x'$, $v_y'$, (green) $v_x'$, $v_z'$ and (red) $v_y'$, $v_z'$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 45-cm, y = 15, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v_x'$, $v_y'$, (green) $v_x'$, $v_z'$ and (red) $v_y'$, $v_z'$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 55-cm, y = 25, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v_x'$, $v_y'$, (green) $v_x'$, $v_z'$ and (red) $v_y'$, $v_z'$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 60-cm, y = 34, z = 7-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, and (red) $v'_x$, $v'_y$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = -25-cm, y = -25, z = 8-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, and (red) $v'_x$, $v'_y$ – upstream of vane – Experimental results.

Turbulent velocities fields at point (x = 15-cm, y = -15, z = 8-cm), each dot represents a pair at a certain time:
(blue) $v'_x$, $v'_y$, (green) $v'_z$, and (red) $v'_x$, $v'_y$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 25-cm, y = -5 z = 8-cm), each dot represents a pair at a certain time:
(b) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 35-cm, y = 0, z = 8-cm), each dot represents a pair at a certain time:
(b) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 45-cm, y = 15, z = 8-cm), each dot represents a pair at a certain time:
(b) $v'_x$, $v'_y$, (green) $v'_z$, $v'_z$ and (red) $v'_y$, $v'_z$ – downstream of vane – Experimental results.
Turbulent velocities fields at point (x = 55-cm, y = 25, z = 8-cm), each dot represents a pair at a certain time: 
(blue) $v'_x, v'_y$, (green) $v'_z, v'_x$ and (red) $v'_y, v'_z$ – downstream of vane – Experimental results.

Turbulent velocities fields at point (x = 60-cm, y = 34, z = 8-cm), each dot represents a pair at a certain time: 
(blue) $v'_x, v'_y$, (green) $v'_z, v'_x$ and (red) $v'_y, v'_z$ – downstream of vane – Experimental results.
D.3 Fluctuating Velocities and Reynolds Stresses Histograms

I. Fluctuating Velocities

Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 1-cm):

(a) $u'_x$, (b) $v'_y$ and (c) $w'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 1-cm):

(a) $u'_x$, (b) $v'_y$ and (c) $w'_z$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point $(x = 15\text{-}cm, y = -15, z = 2\text{-}cm)$:
(a) $v'_x$, (b) $v'_y$, and (c) $v'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point $(x = 35\text{-}cm, y = 0, z = 2\text{-}cm)$:
(a) $v'_x$, (b) $v'_y$, and (c) $v'_z$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 3-cm):
(a) $v'_x$, (b) $v'_y$, and (c) $v'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 3-cm):
(a) $v'_x$, (b) $v'_y$, and (c) $v'_z$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 4-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 4-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 5-cm): (a) $v_x'$, (b) $v_y'$ and (c) $v_z'$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 5-cm): (a) $v_x'$, (b) $v_y'$ and (c) $v_z'$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 6-cm):
(a) $v_x'$, (b) $v_y'$ and (c) $v_z'$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 6-cm):
(a) $v_x'$, (b) $v_y'$ and (c) $v_z'$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 7-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 7-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.
Histogram of the relative distribution of the instantaneous velocity field at point (x = 15-cm, y = -15, z = 8-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.

Histogram of the relative distribution of the instantaneous velocity field at point (x = 35-cm, y = 0, z = 8-cm):
(a) $v'_x$, (b) $v'_y$ and (c) $v'_z$ - Experimental results.
II. Reynolds Stresses

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
\((x = 15\text{-cm}, y = -15, z = 1\text{-cm})\) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
\((x = 35\text{-cm}, y = 0, z = 1\text{-cm})\) – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 15-cm, y = -15, z = 2-cm) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 35-cm, y = 0, z = 2-cm) – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point $(x = 15\text{-cm}, y = -15, z = 3\text{-cm})$ – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point $(x = 35\text{-cm}, y = 0, z = 3\text{-cm})$ – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point $(x = 15\text{-cm}, y = -15, z = 4\text{-cm})$ – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point $(x = 35\text{-cm}, y = 0, z = 4\text{-cm})$ – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 15-cm, y = -15, z = 5-cm) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 35-cm, y = 0, z = 5-cm) – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 15-cm, y = -15, z = 6-cm) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 35-cm, y = 0, z = 6-cm) – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 15-cm, y = -15, z = 7-cm) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
(x = 35-cm, y = 0, z = 7-cm) – Experimental results.
Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
\((x = 15\text{-cm}, y = -15, z = 8\text{-cm})\) – Experimental results.

Histogram of the probability density function of Reynolds normal and shear stresses, in the x-y plane at point 
\((x = 35\text{-cm}, y = 0, z = 8\text{-cm})\) – Experimental results.
APPENDIX E.

RESULTS – PRESSURES
Appendix E Results – Pressures

1. Experiment I – Total Pressures

Total pressures (cm-wc) on the left-side of vane, points from 1 to 30 – Experiment (I) results.

Total pressures (cm-wc) acts on the right-side of vane, points from 31 to 60 – Experiment (I) results.
Pressures difference between submerged vane sides – Experiment (I) results.
2. Experiment II – Total Pressures

Total pressures (cm-wc) on the left-side of vane, points from 1 to 30 – Experiment (II) results.

Total pressures (cm-wc) acts on the right-side of vane, points from 31 to 60 – Experiment (II) results.
Pressures difference between vane sides: 33.612053 N/m². Resultant Force $F_r$: 0.992359 N.

Pressures difference between submerged vane sides – Experiment (II) results.
3. Experiment III – Total Pressures

Total pressures (cm-we) on the left-side of vane, points from 1 to 30 – Experiment (III) results.

Total pressures (cm-we) acts on the right-side of vane, points from 31 to 60 – Experiment (III) results.
Pressures difference between submerged vane sides – Experiment (III) results.
4. Experiment IV – Total Pressures

Total pressures (cm-wc) on the left-side of vane, points from 1 to 30 – Experiment (IV) results.

Total pressures (cm-wc) acts on the right-side of vane, points from 31 to 60 – Experiment (IV) results.
Pressures difference between submerged vane sides – Experiment (IV) results.

Pressure difference between vane sides: 13.599929 N/m², Resultant Force $F_r$: 0.240392 N
5. Experiment V – Total Pressures

Total pressures (cm-we) on the left-side of vane, points from 1 to 30 – Experiment (V) results.

Total pressures (cm-we) acts on the right-side of vane, points from 31 to 60 – Experiment (V) results.
Pressures difference between submerged vane sides – Experiment (V) results.
6. Experiment VI – Total Pressures

Total pressures (cm-wc) on the left-side of vane, points from 1 to 30 – Experiment (VI) results.

Total pressures (cm-wc) acts on the right-side of vane, points from 31 to 60 – Experiment (VI) results.
Pressures difference between submerged vane sides – Experiment (VI) results.

Pressure difference between vane sides: 16.744181 Nm$^2$, Resultant Force $F_r$: 0.295970 N