DAFTAR PUSTAKA

Adi, Prasetyo dan Amiadji. 2013. "Analisa Penerapan Bulbous Bow pada Kapal Katamaram untuk Meningkatkan Efisiensi Pemakaian Bahan Bakar". ITS.F-15. Surabaya

Adji, Suryo W. 2009. "Resistance & Propulsion Modul 1: Introduction to Ship Resistance". Surabaya

Aprianto, Agung. 2019. Studi Tahanan Kapal Semi Displacement. Makassar: Departement Teknik Perkapalan Universitas Hasanuddin.

Baso, S., Ardianti, A., Rosmani, A. Ade Anggriani. (2021). An Extended Validation of Free CFD Application to Ship Resistance Prediction for Using In Preliminary Design Stage. Journal of Engineering Science and Technology, 16(3), 2544-2561.

https://id.wikipedia.org/wiki/Kapal_tunda Diakses pada tanggal 9 Juni

Harvald. A, 1998. "Tahanan dan Propulsi Kapal". Surabaya: Airlangga University Press

Peraturan Menteri Perhubungan Republik Indonesia Nomor PM. 48 tahun 2018 Tentang Angkutan Laut.

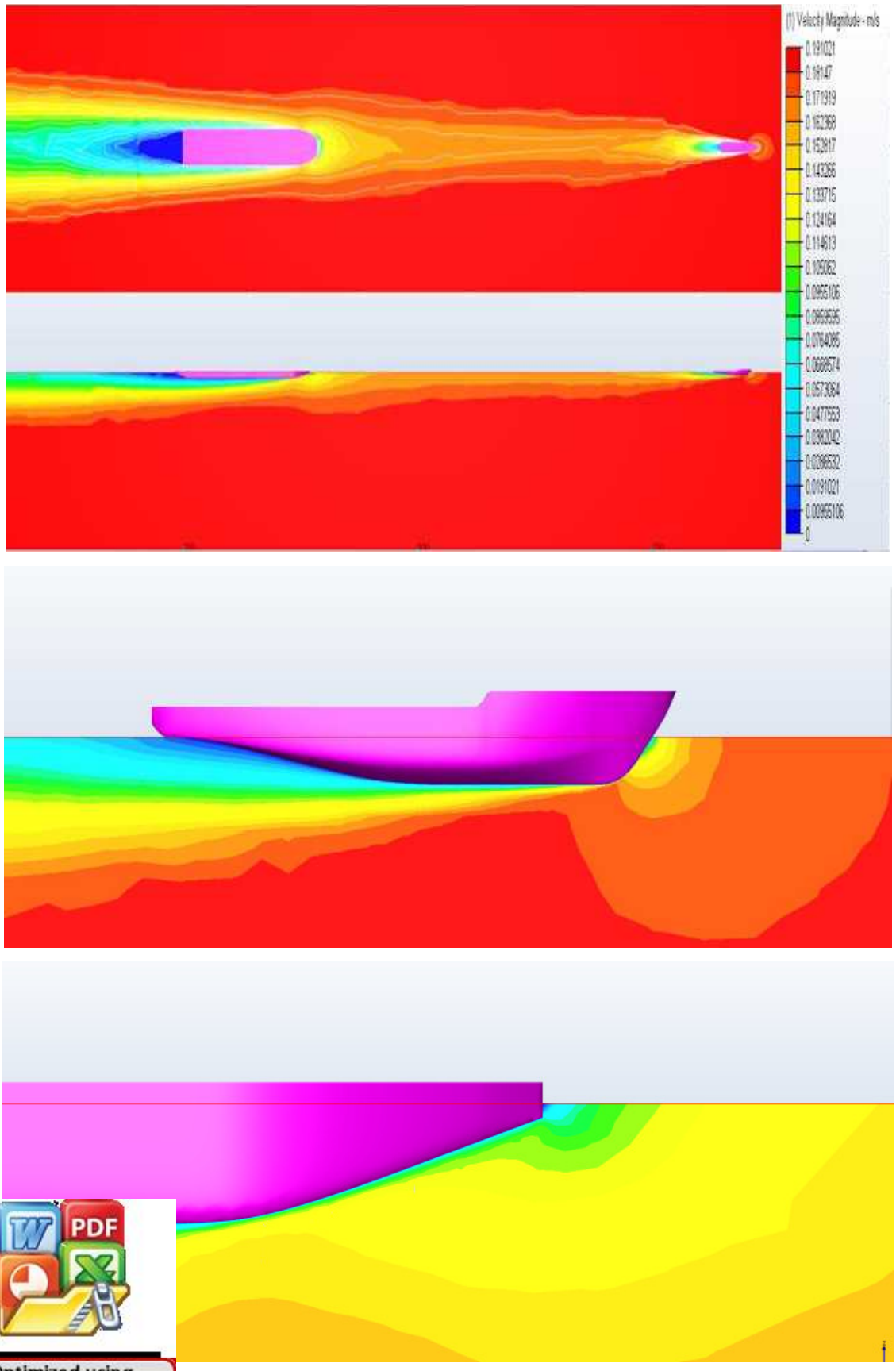
Rasidi, Ahmad A. 2019. "Komparasi Tahanan Kapal Menggunakan Bulbous Bow dan Tanpa Bulbous Bow berdasarkan Analisis CFD (Computational Fluid Dynamic)". Unhas. Makassar

Sardjadi, Djoko. 2003. Mekanika Fluida. Bandung.

Sv. Harvald. 1992. "Tahanan dan Propulsi Kapal". Airlangga. Surabaya Autodesk CFD. (2015, 28 Desember). Autodesk Knowladge Networks. Diperoleh 10 April 2018, dari https://knowledge.autodesk.com/support/cfd/learn explore/caas/CloudHelp/cloudhelp/2014/ENU/SimCFD/files/GUID-46AC3A14 5C6E-485D-95BA-E174F1BC1A47-htm.html

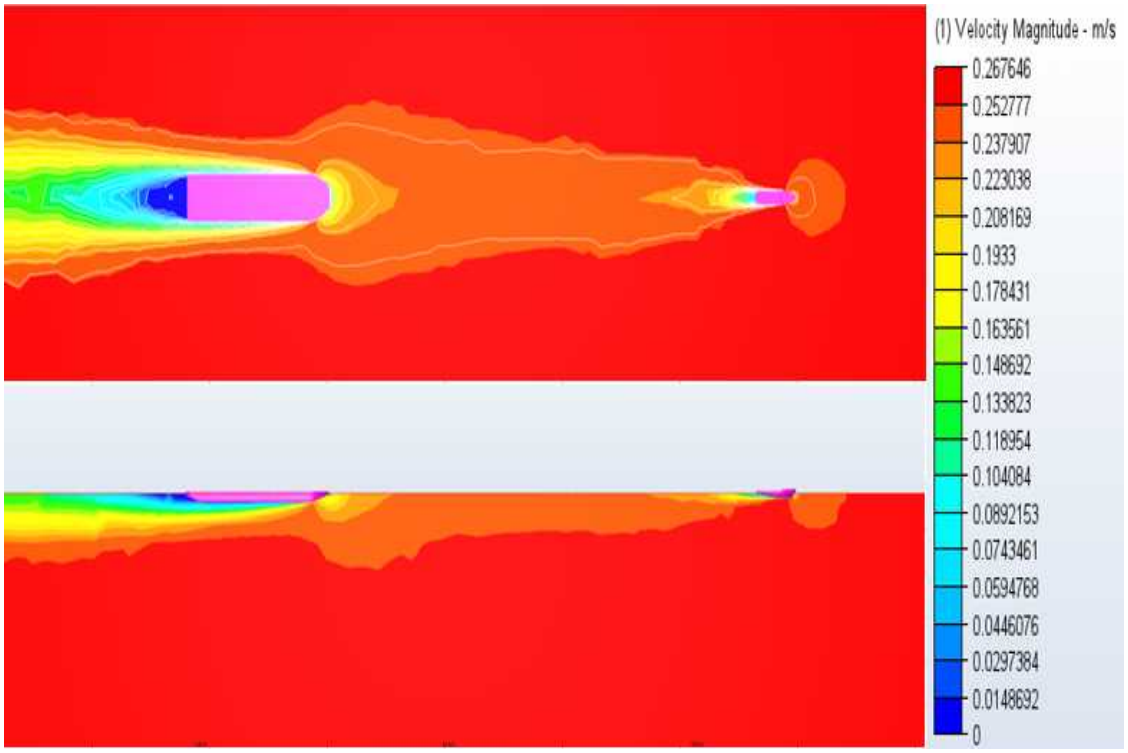
Lampiran 1. Visualisasi Velocity Magnitude pada setiap kecepatan

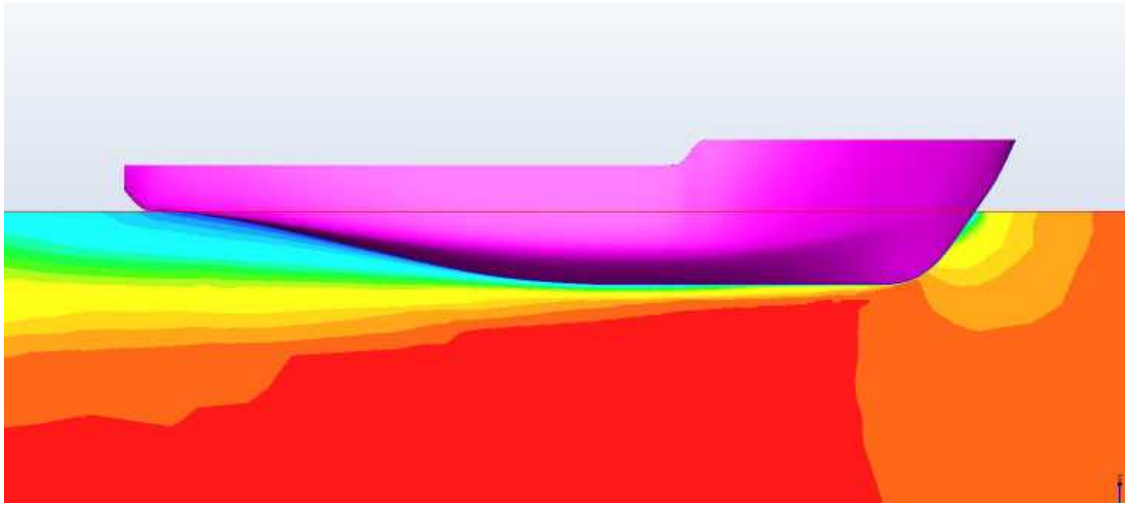
- Kecepatan 3 knot



Visualisasi velocity magnitude **3 L**

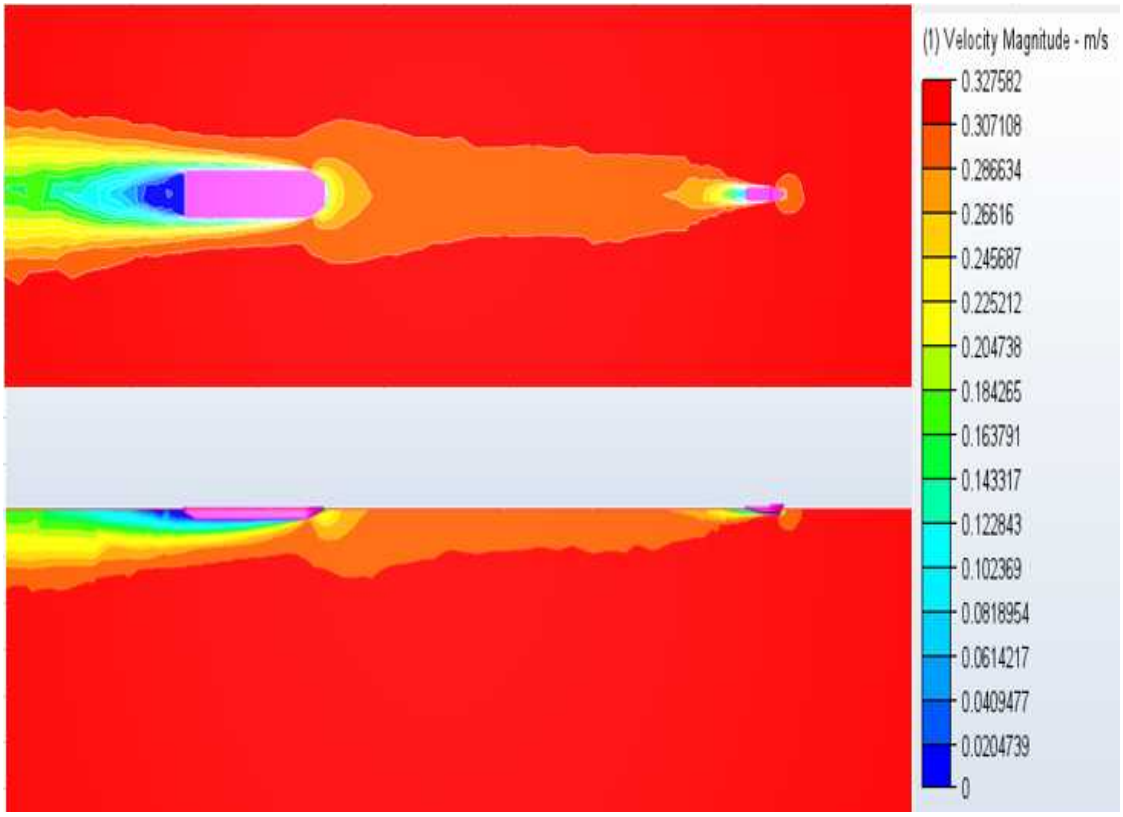
- Kecepatan 4 knot

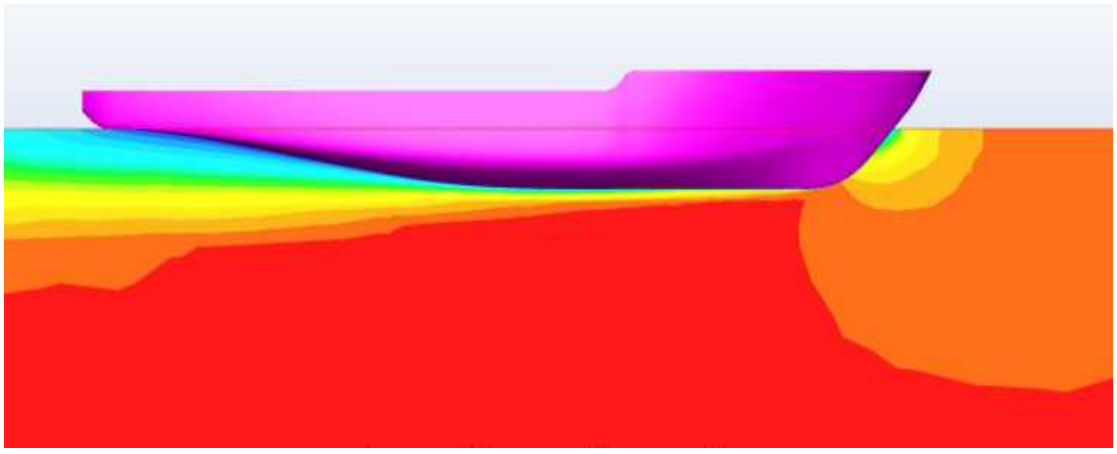


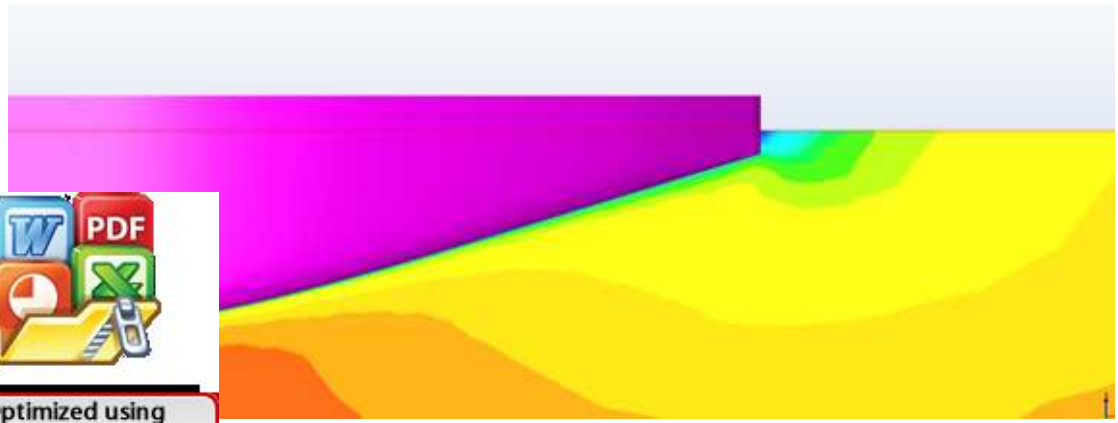


Visualisasi velocity magnitude **3 L**

➢ Kecepatan 5 knot



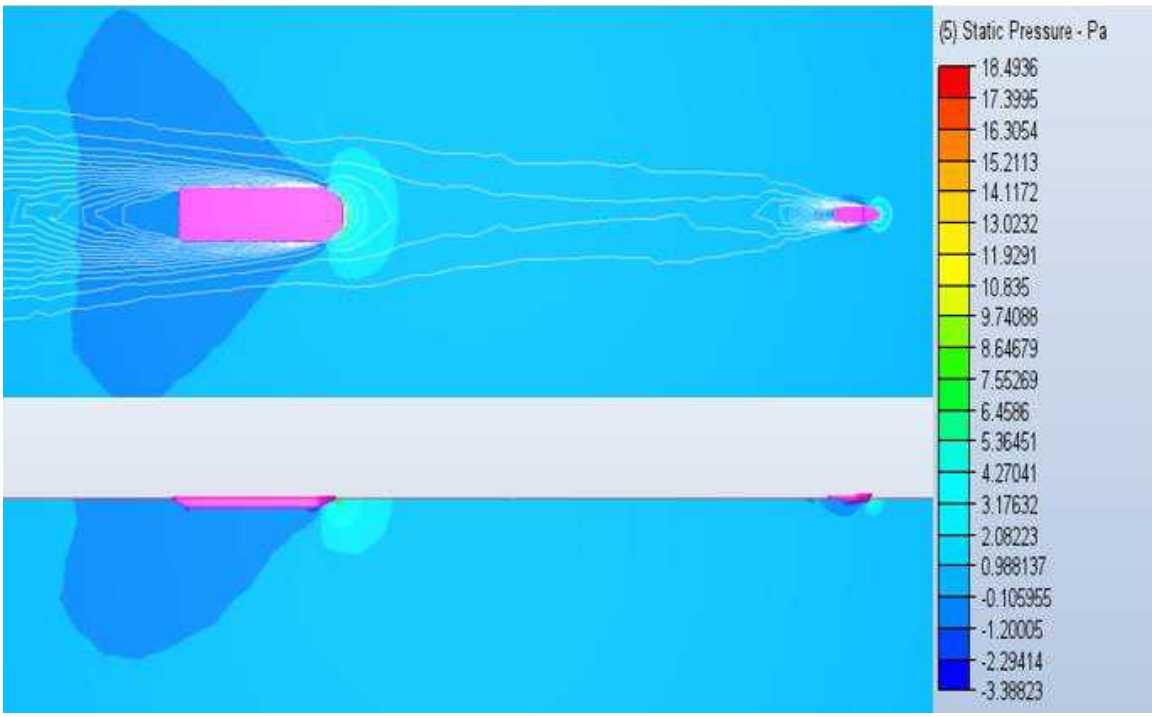


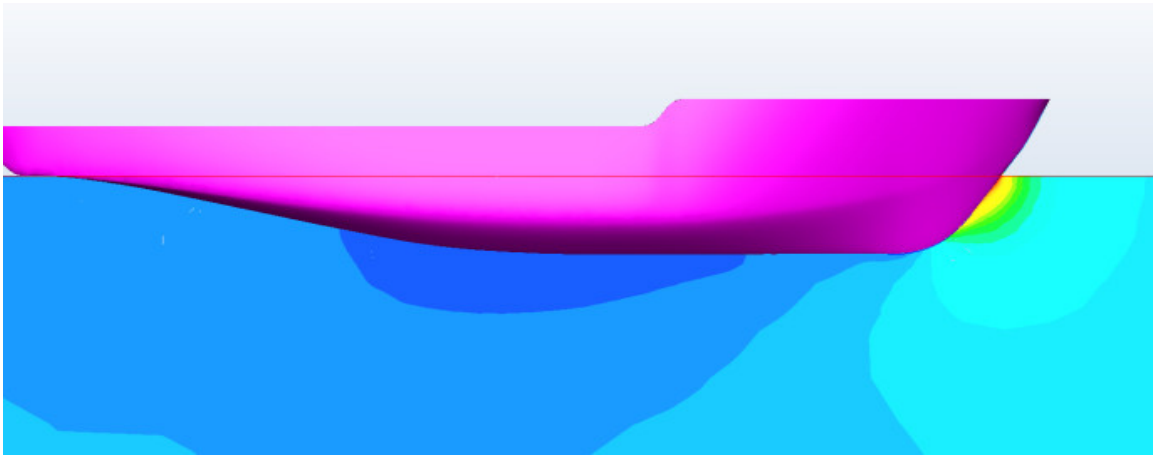


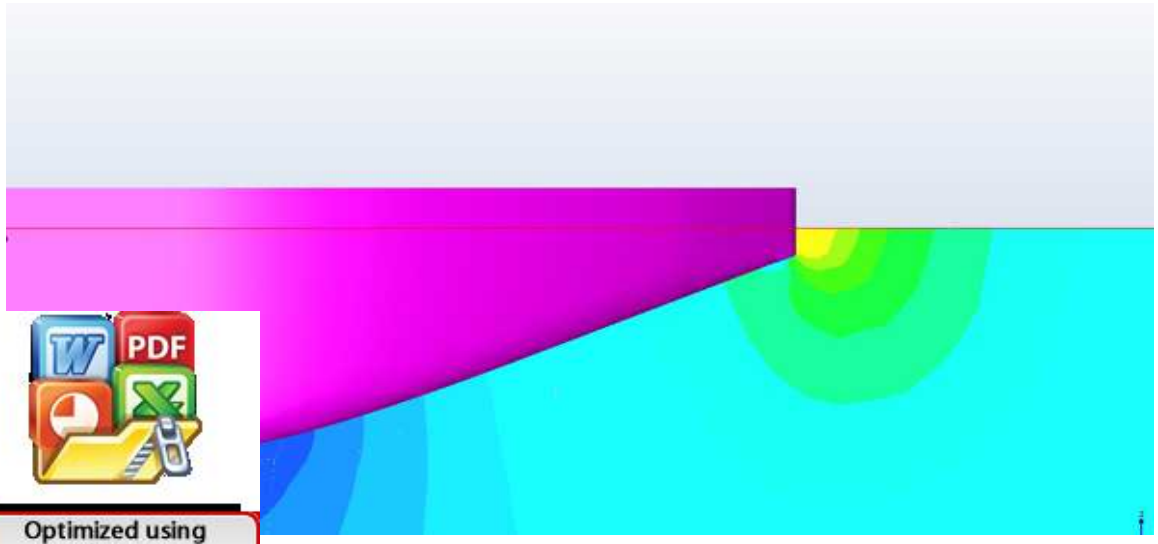
Visualisasi velocity magnitude **3 L** tampak atas

Lampiran 2. Visualisasi Static Pressure pada setiap kecepatan

- Kecepatan 3 knot

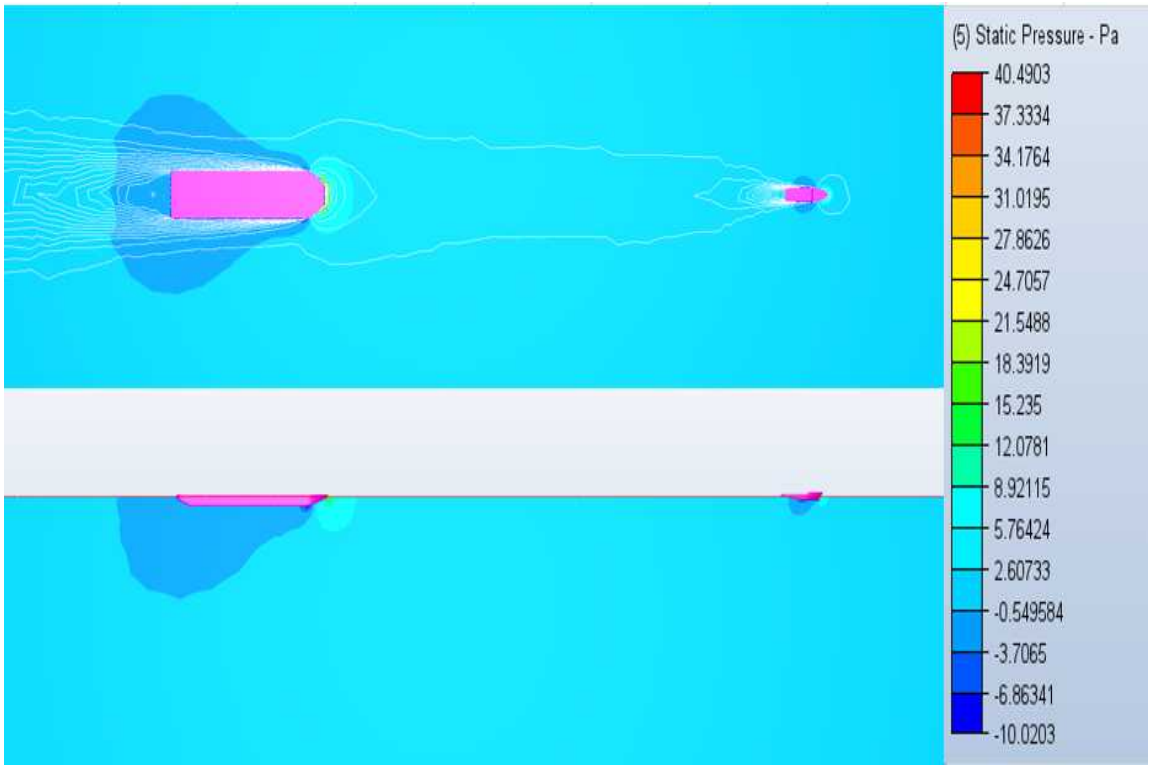


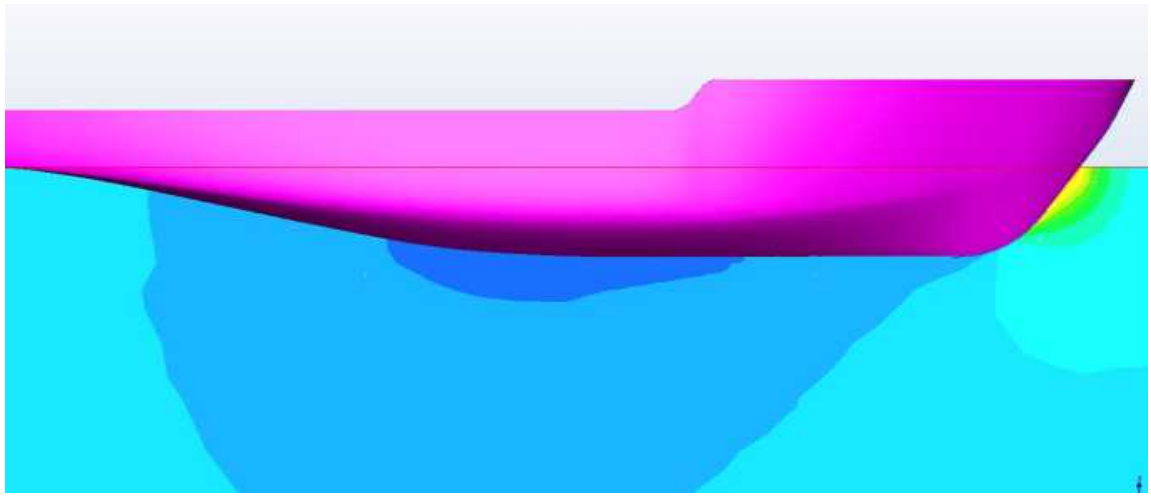


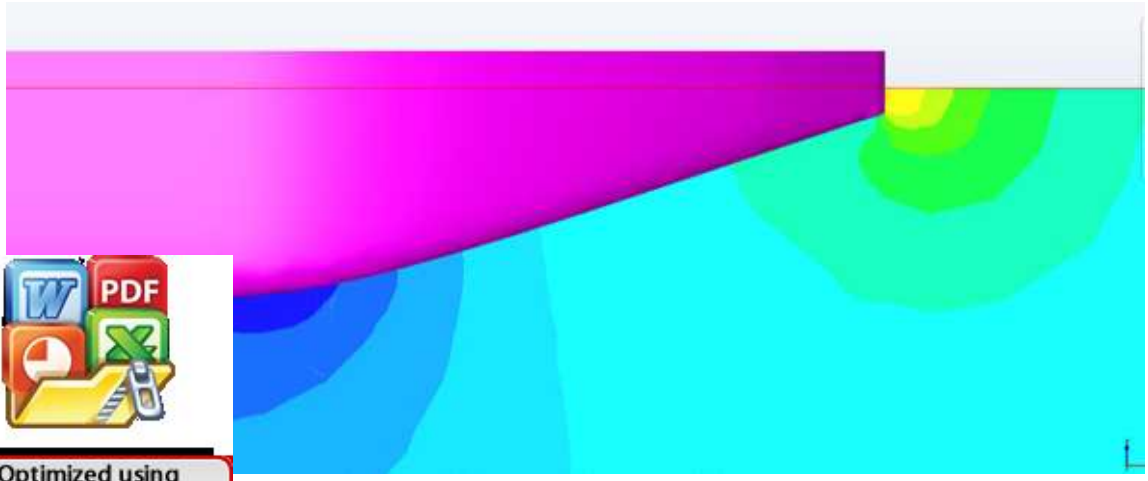


Static pressure **3 L** tampak atas kecepatam 3 knot

- Kecepatan 4 knot

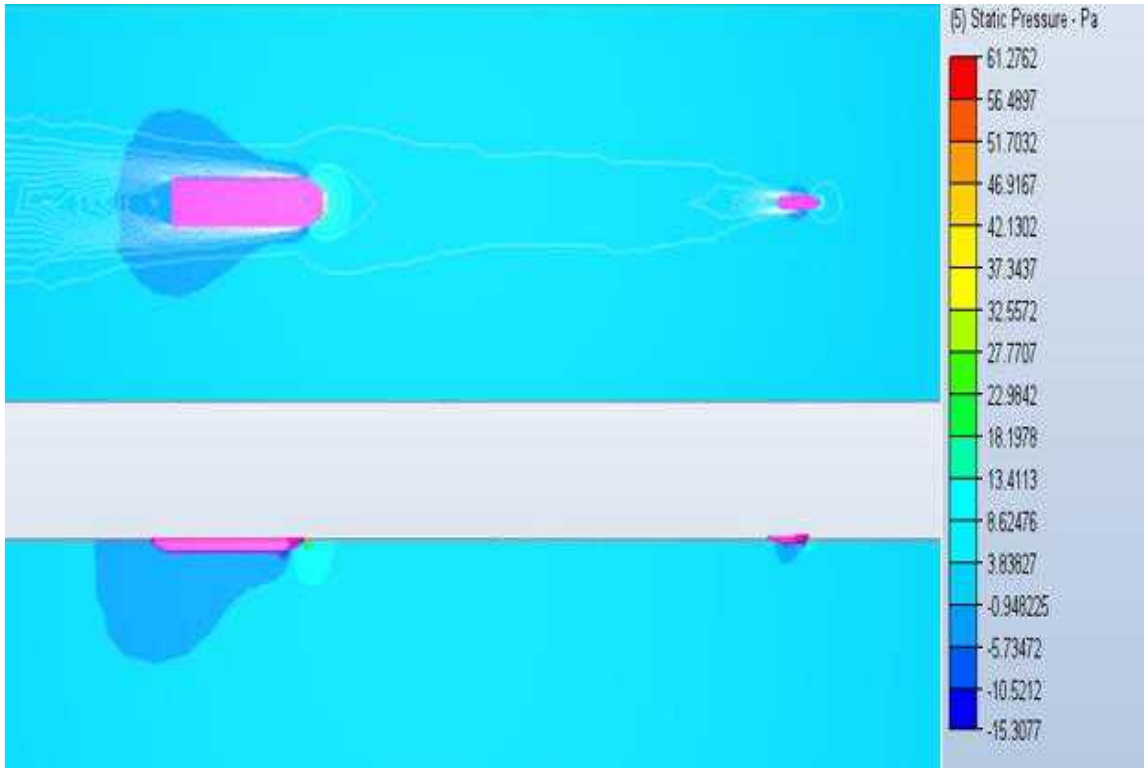


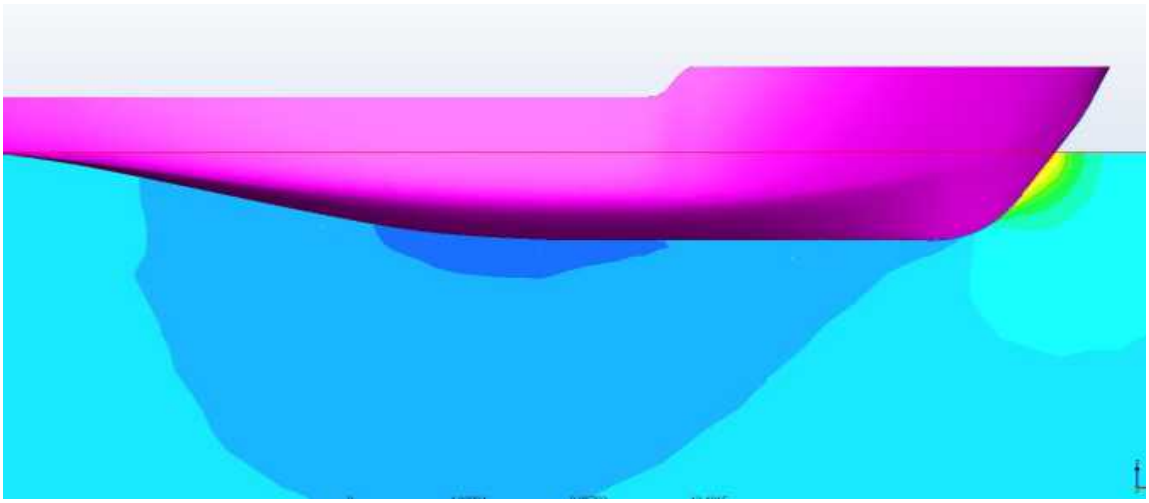


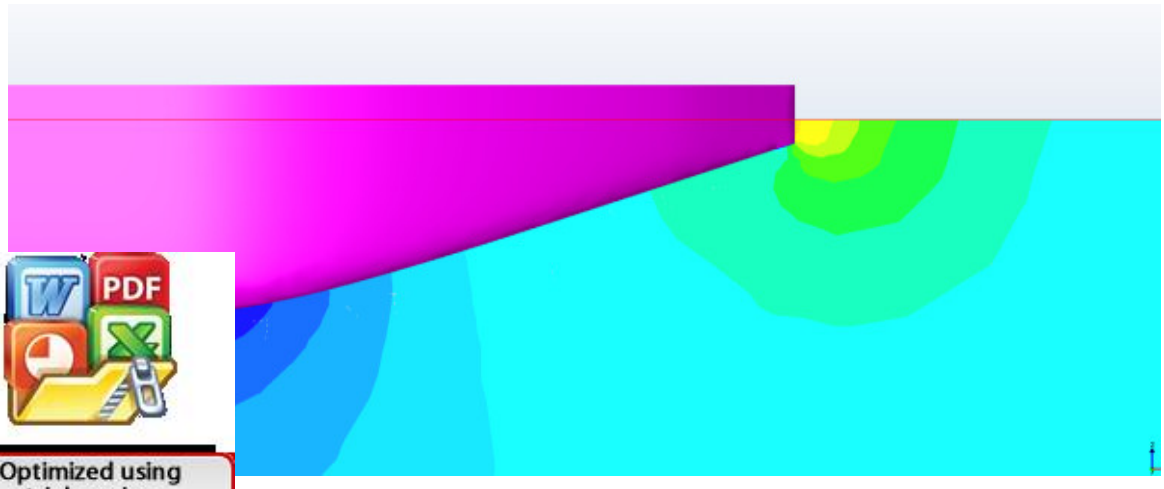


Static pressure **3 L** tampak atas kecepatan 4 knot

- Kecepatan 5 knot



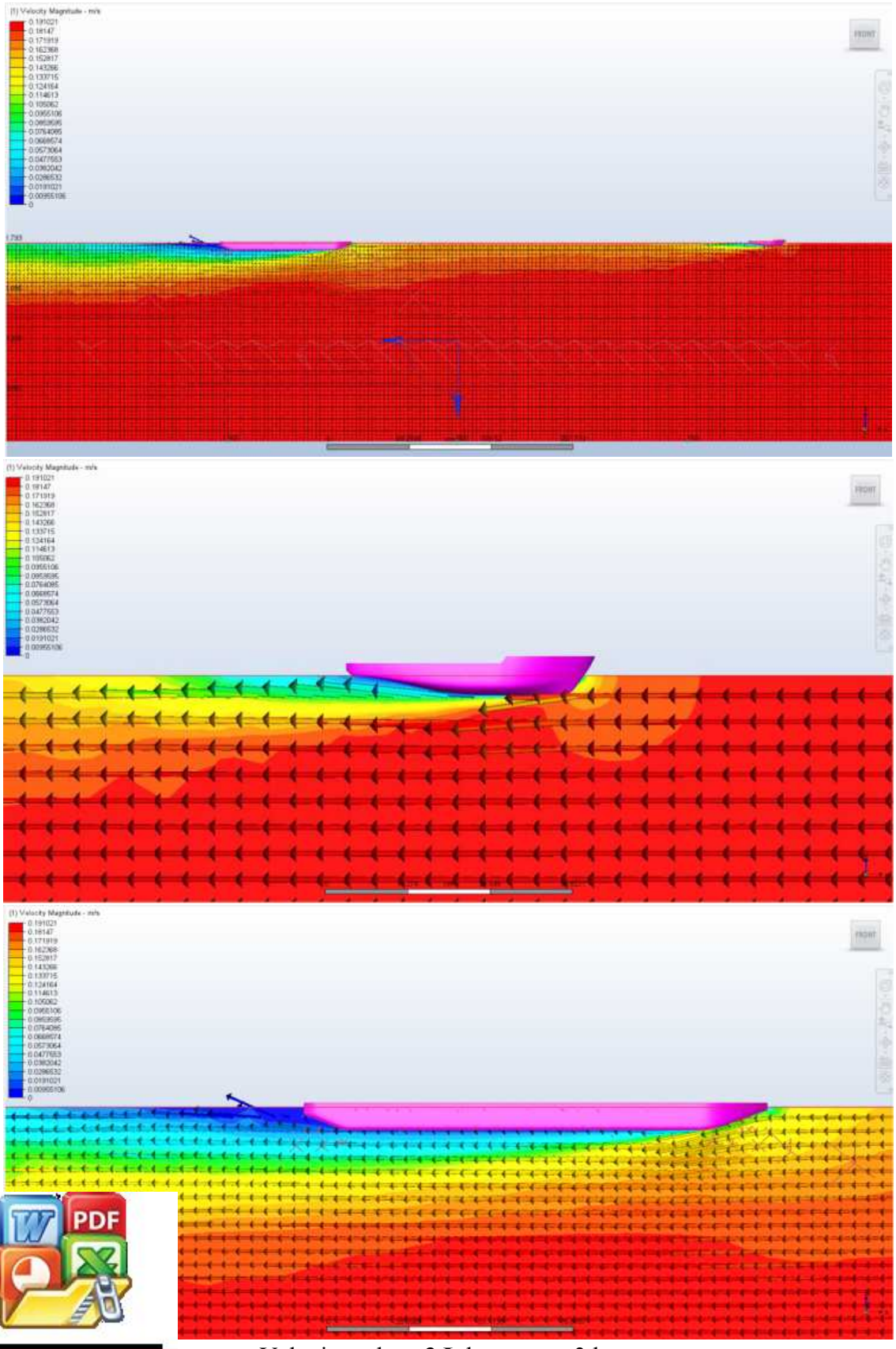




Static pressure **3 L** tampak atas kecepatan 5 knot

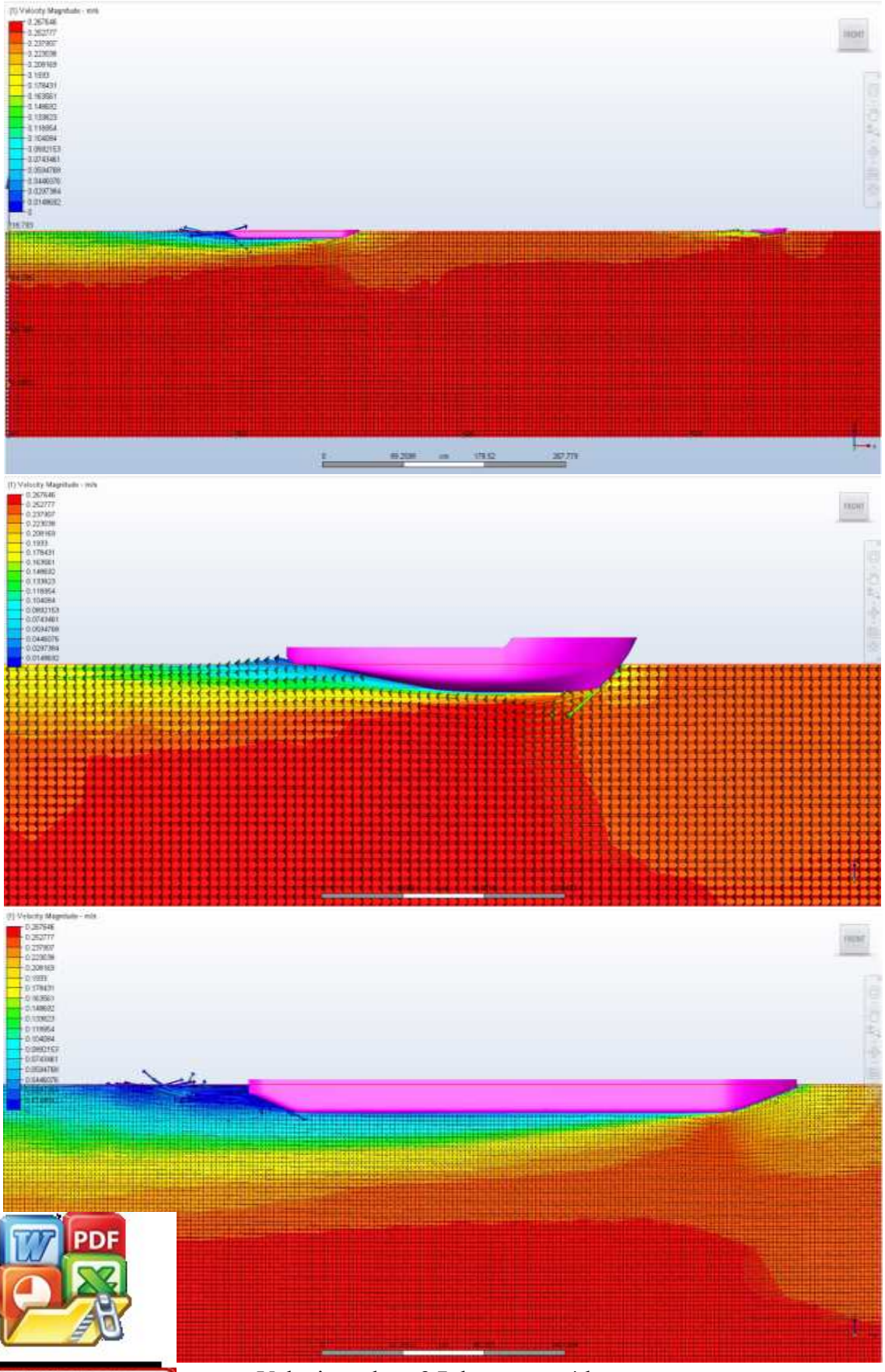
Lampiran 3. Visualisasi velocity vector pada setiap kecepatan

- Kecepatan 3 knot



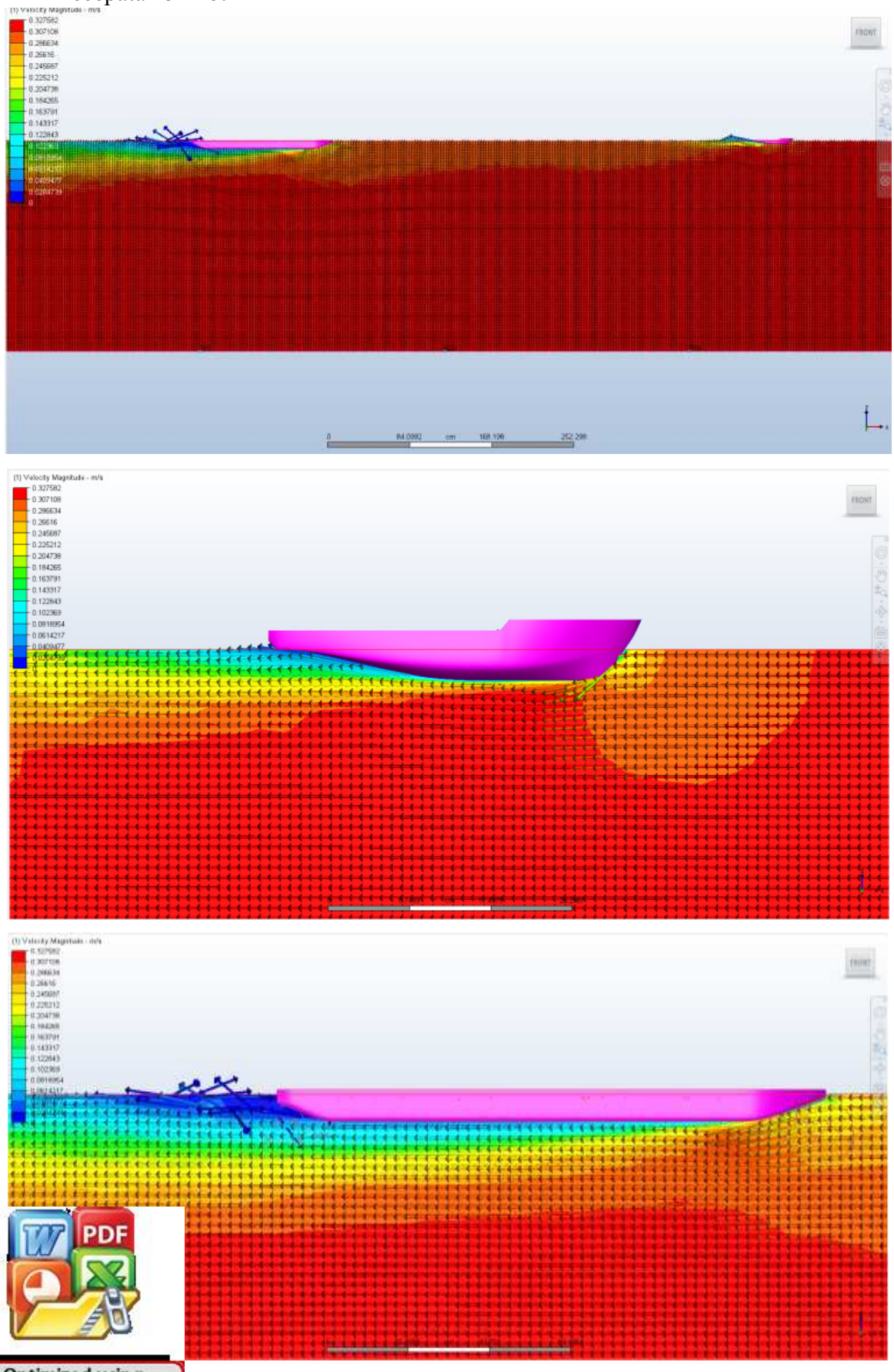
Velocity vektor **3 L** kecepatan 3 knot

➢ Kecepatan 4 knot



Velocity vektor **3 L** kecepatan 4 knot

➢ Kecepatan 5 knot



Velocity vektor **3 L** kecepatan 5 knot

Lampiran 4. Data statistik jumlah elemen mesh

- Kecepatan 3 knot

No	Material	Model Size	
		Nodes	Element
1	Fluid	381181	1417659
2	Solid (model)	913591	4798484
Total		1294772	5216143

- Kecepatan 4 knot

No	Material	Model Size	
		Nodes	Element
1	Fluid	381181	1417659
2	Solid (model)	913591	4798484
Total		1294772	6216143

- Kecepatan 5 knot

No	Material	Model Size	
		Nodes	Element
1	Fluid	381181	1417659
2	Solid (model)	913591	4798484
Total		1294772	6216143

Lampiran 5. Penentuan nilai kecepatan model kapal (V_m)

Berdasarkan persamaan 2.20 dimana $\frac{vm}{\sqrt{g.Lm}} = \frac{vs}{\sqrt{g.Ls}}$ maka dalam menentukan kecepatan model kapal sebagai berikut.

- Kecepatan 3 knot

$Fn_s = \frac{vs}{\sqrt{g.Ls}}$

$= \frac{1.543}{\sqrt{9.81\ x\ 100.584}}$

$= 0.049$

$Fn_s = Fn_m = 0.049$

Maka, $Fn_s = \frac{vm}{\sqrt{g.Lm}}$

$0.049 = \frac{vm}{\sqrt{9.81\ x\ 1.437}}$

$Vm = \mathbf{0.184}$ m/s

- Kecepatan 4 knot

$Fn_s = \frac{vs}{\sqrt{g.Ls}}$

$= \frac{2.057}{\sqrt{9.81\ x\ 100.584}}$

$= 0.065$

$Fn_s = Fn_m = 0.065$

Maka, $Fn_s = \frac{vm}{\sqrt{g.Lm}}$

$0.065 = \frac{vm}{\sqrt{9.81\ x\ 1.437}}$

$Vm = \mathbf{0.253}$ m/s

- Kecepatan 5 knot

$Fn_s = \frac{vs}{\sqrt{g.Ls}}$

$= \frac{2.572}{\sqrt{9.81\ x\ 100.584}}$

$= 0.0818 = 0.082$

: $Fn_m = 0.082$

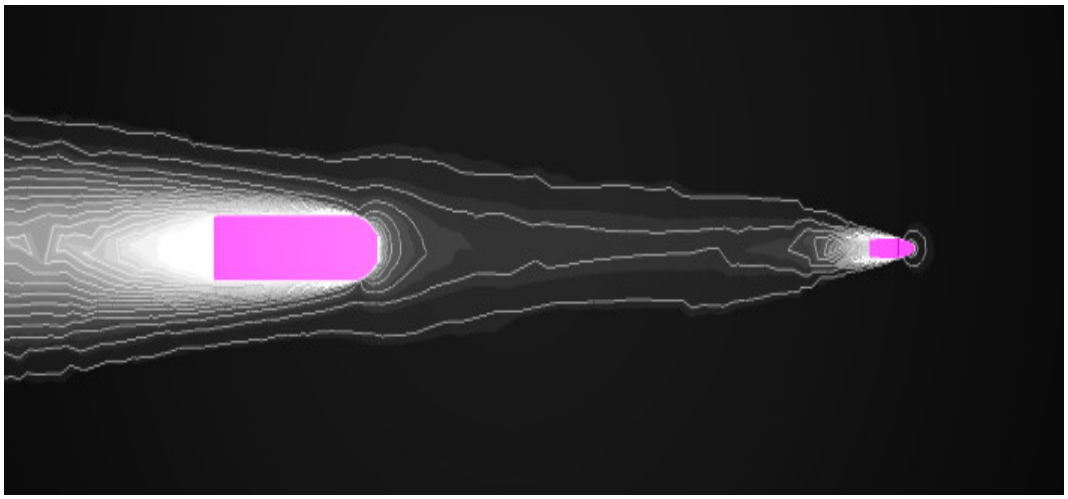
$= \frac{vm}{\sqrt{g.Lm}}$

2 $= \frac{vm}{\sqrt{9.81\ x\ 1.437}}$

$= \mathbf{0.307}$ m/s

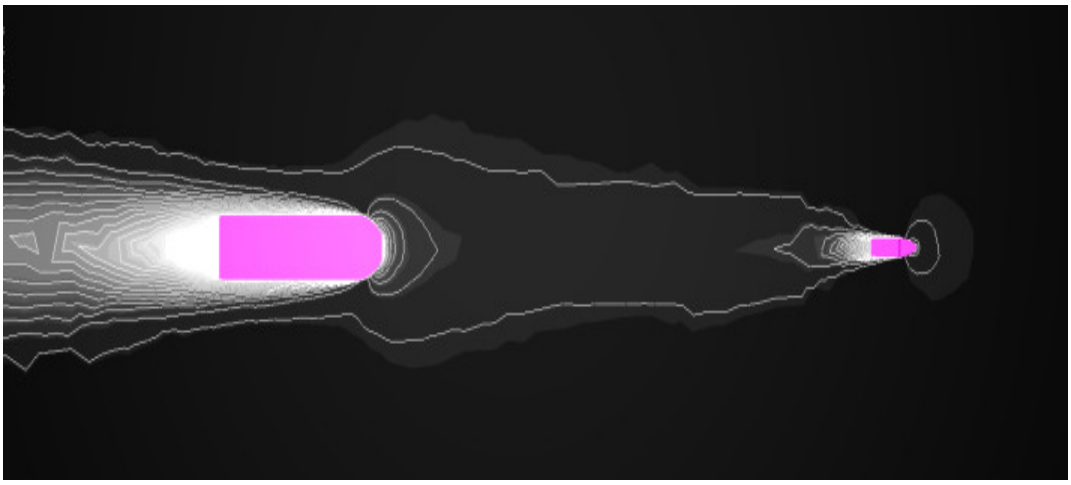
Lampiran 6. Visualisasi Pola Aliran pada setiap kecepatan

- Kecepatan 3 knot



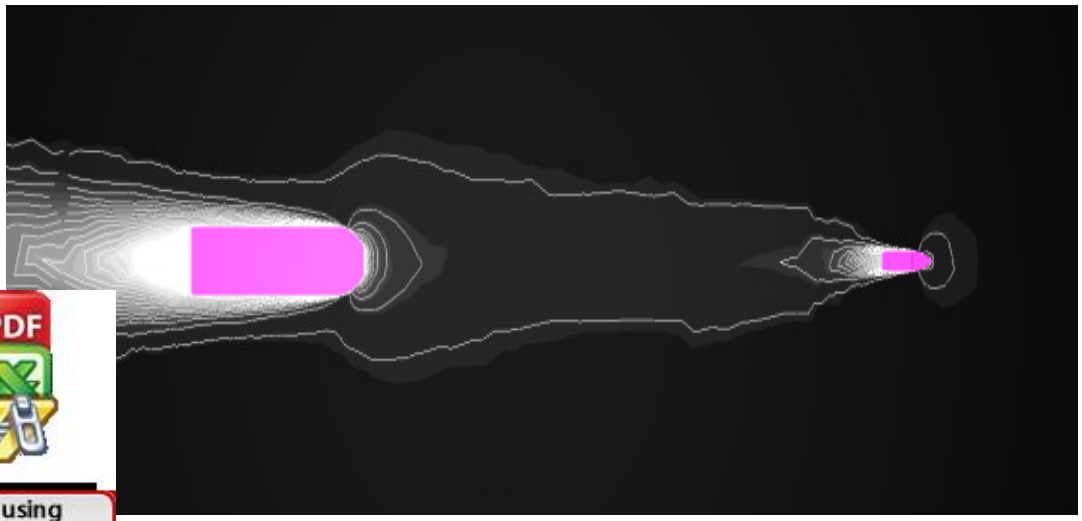
Visualisasi Pola Aliran kecepatan 3 knot

- Kecepatan 4 knot



Visualisasi Pola Aliran kecepatan 4 knot

- Kecepatan 5 knot



Visualisasi Pola Aliran kecepatan 5 knot

Lampiran 7. Persentase tahanan dan rata – rata untuk model kapal Tugboat dan Tongkang.

- Model kapal Tugboat

Panjang tali	Kecepatan (knot)	Tahanan Tugboat	Persentase tahanan tugboat	Rata - rata
3 L	3	0.01695	0.09%	0.085%
	4	0.02917		
	5	0.04133	0.08%	

- Model kapal Tongkang

Panjang tali	Kecepatan (knot)	Tahanan tongkang	Persentase tahanan tongkang	Rata - rata
3 L	3	0.14251	2.73%	2.78%
	4	0.28740		
	5	0.41118	2.84%	