

F3OF Modelling Results

December 20, 2017

Contents

1	F3OF System Overview	2
2	HDB	3
2.1	Added Mass	3
2.2	Damping	6
3	Decay Tests	9
3.1	Initial Position Calculations	9
3.1.1	DT1	9
3.1.2	DT2	10
3.1.3	DT3	11
4	Time Domain Comparison	12
4.1	Decay Tests	12
4.1.1	DT1	12
4.1.2	DT2	13
4.1.3	DT3	15
5	RAOs	19
5.1	Surge RAO	19
5.2	Heave RAO	20
5.3	Pitch RAO	21

1 F3OF System Overview

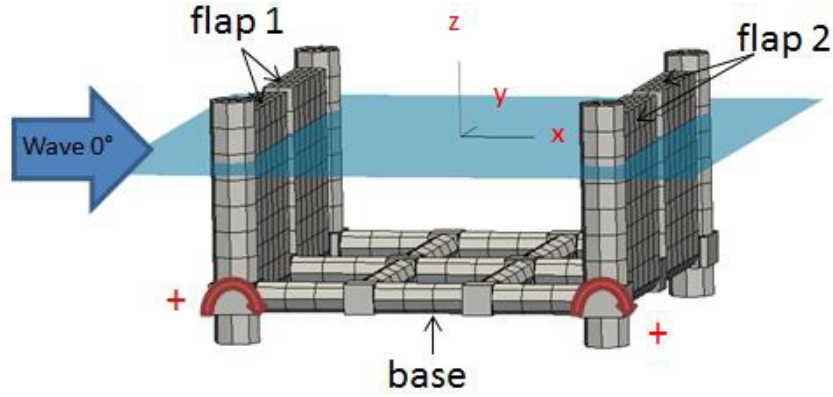


Figure 1: Schematic of the F3OF device.

Key parameters are taken from [?] ¹

Table 1: F3OF System - Key Parameters

Parameter	Base	Flap 1	Flap 2
Mass (kg)	1089825	179250	179250
COG - x (m)	0	-12.5	12.5
COG - y (m)	0	0	0
COG - z (m)	-9	-5.5	-5.5
Pitch inertia around body COG (kg.m ²)	76300000	1300000	1300000
Mooring stiffness (N/m)	100000	n/a	n/a

¹N.B. Some parameters given in ‘InWave - Validation Manual v1.0.0-beta2’ differ to the paper.

2 HDB

2.1 Added Mass

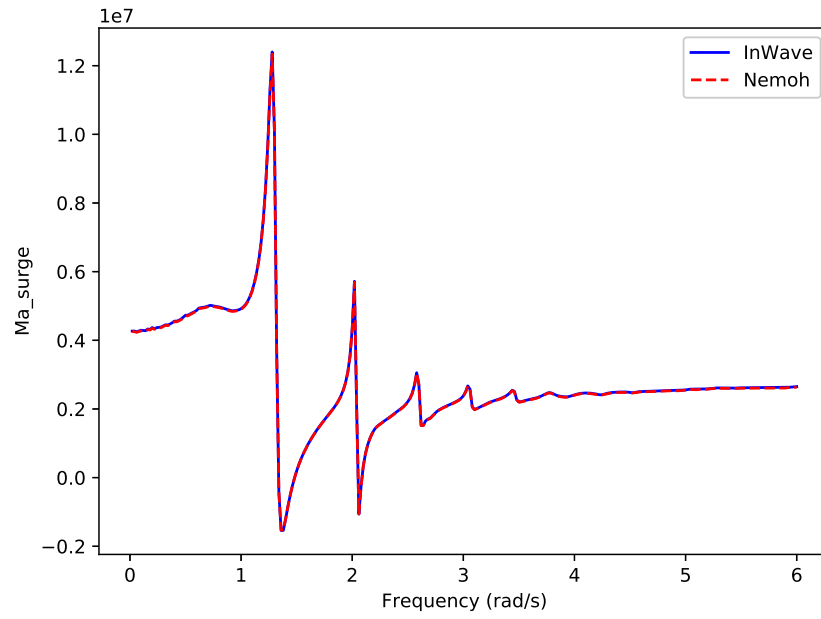


Figure 2: HDB Comparison: Added Mass in Surge Comparison.

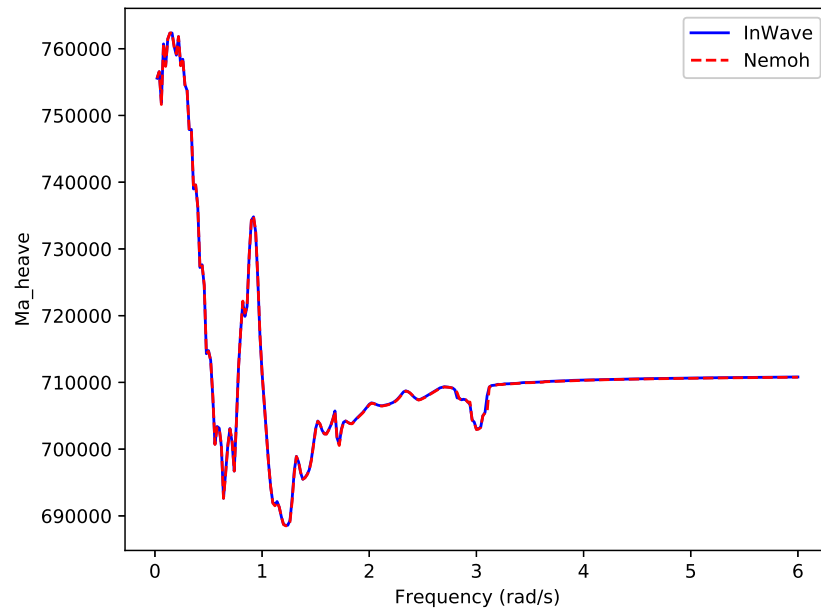


Figure 3: HDB Comparison: Added Mass in Heave Comparison.

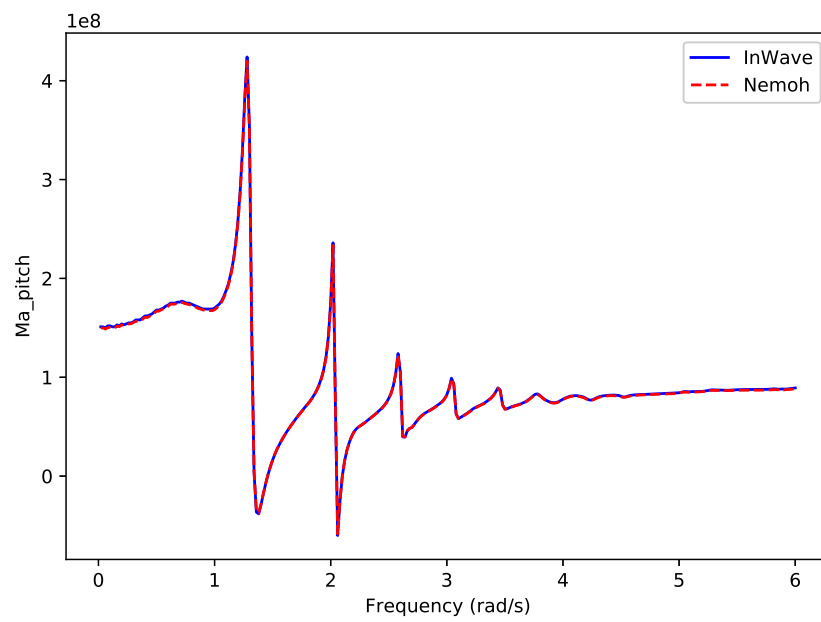


Figure 4: HDB Comparison: Added Mass in Pitch Comparison.

2.2 Damping

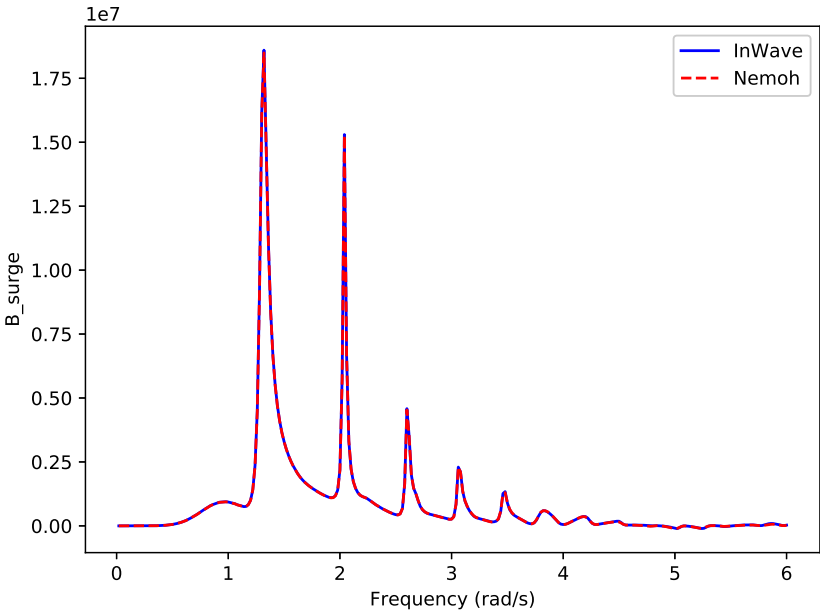


Figure 5: HDB Comparison: Radiation Damping in Surge.

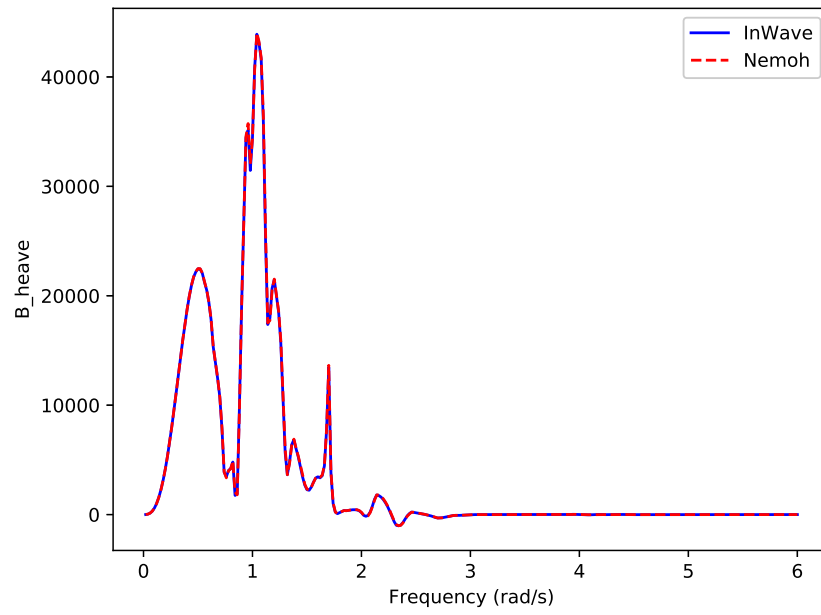


Figure 6: HDB Comparison: Radiation Damping in Heave.

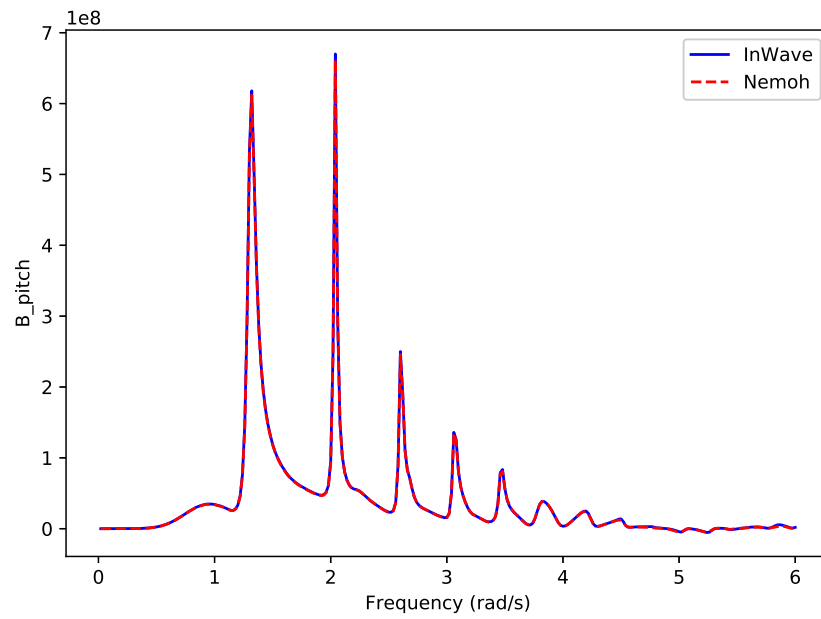


Figure 7: HDB Comparison: Radiation Damping in Pitch.

3 Decay Tests

3.1 Initial Position Calculations

3.1.1 DT1

Linear translation:

$$\vec{p}_{new} = \vec{p}_{eq} + \overrightarrow{offset} \quad (1)$$

Where,

$$\overrightarrow{offset} = \begin{bmatrix} 5 \\ 0 \\ 0 \end{bmatrix} m \quad (2)$$

```
('DT1 Base Position : ', [5, 0, -9])  
( 'DT1 Flap 1 Position : ', [-7.5, 0.0, -5.5])  
( 'DT1 Flap 2 Position : ', [17.5, 0.0, -5.5])
```

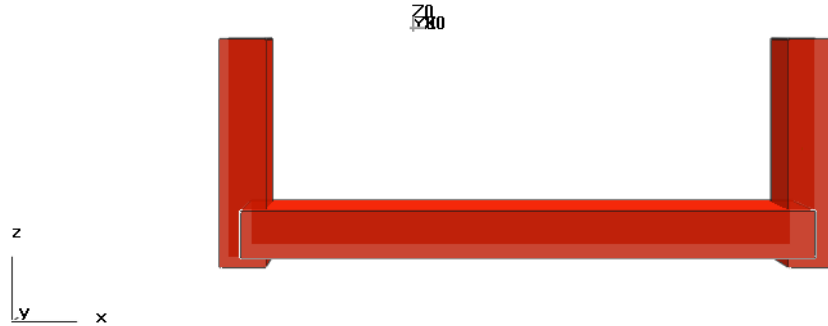


Figure 8: DT1: Initial position.

3.1.2 DT2

Rotate whole system by 10 degrees (about the y axis of the base).

```
('DT2 Base Position : ', [0.0, 0.0, -9.0])  
( 'DT2 Flap 1 Position : ', [-12.437, 0.0, -5.282])  
( 'DT2 Flap 2 Position : ', [12.559, 0.0, -5.719])
```

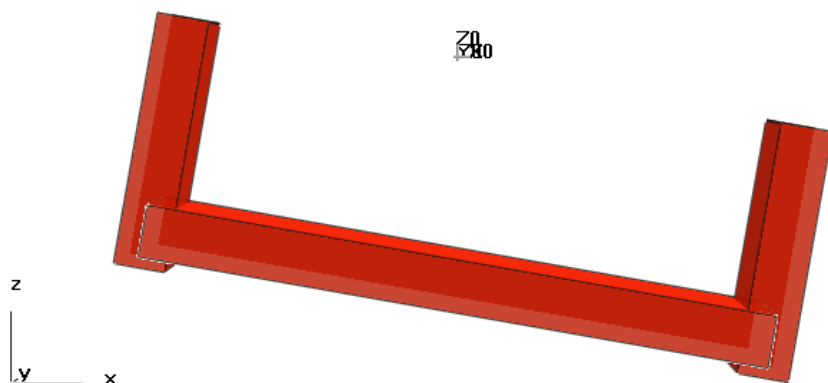


Figure 9: DT2: Initial position.

3.1.3 DT3

Rotate flap 1 by 10 degrees.

```
('DT2 Base Position : ', [0, 0, -9])  
( 'DT2 Flap 1 Position : ', [-11.892, 0.0, -5.553])  
( 'DT2 Flap 2 Position : ', [12.5, 0.0, -5.5])
```

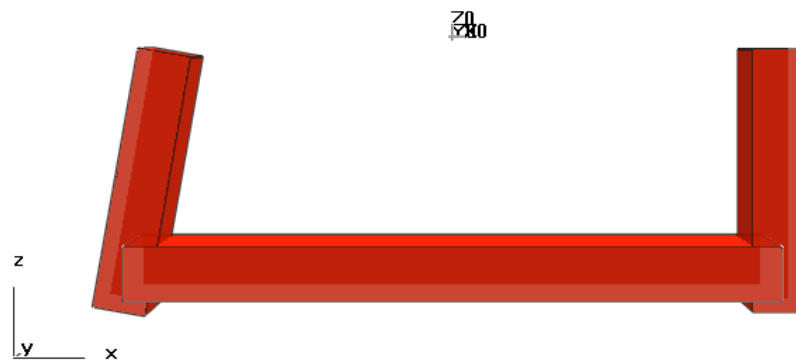


Figure 10: DT2: Initial position.

4 Time Domain Comparison

4.1 Decay Tests

4.1.1 DT1

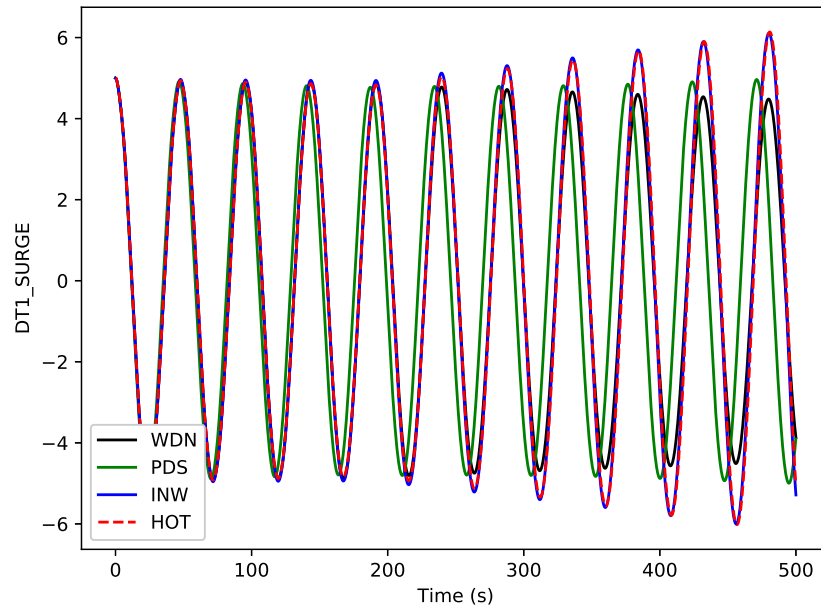


Figure 11: Decay Tests: DT1 Surge Comparison.

4.1.2 DT2

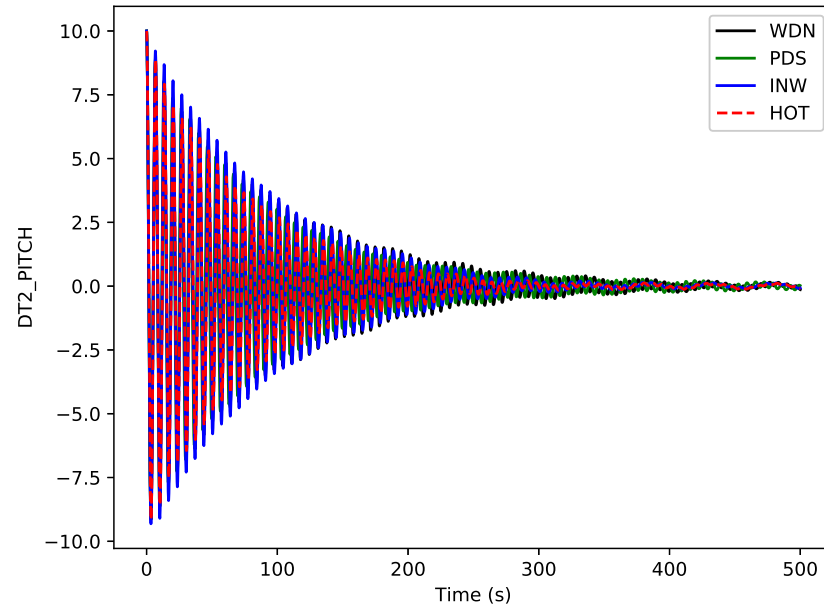


Figure 12: Decay Tests: DT2 Pitch Comparison.

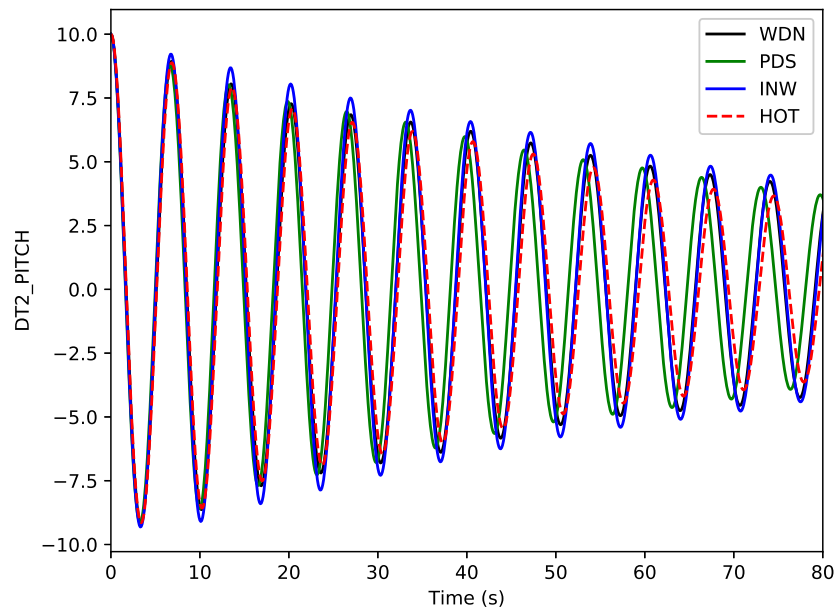


Figure 13: Decay Tests: DT2 Pitch Comparison (zoomed).

4.1.3 DT3

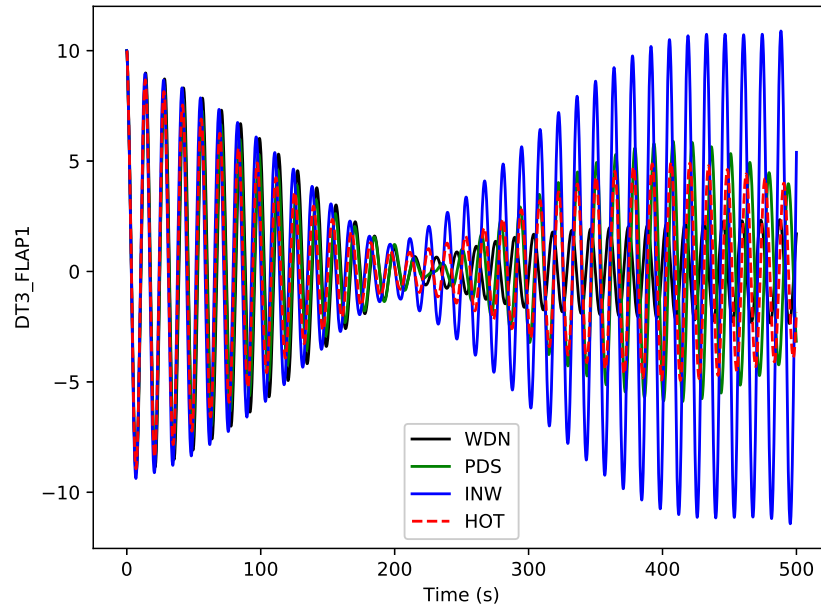


Figure 14: Decay Tests: DT3 Flap 1 Pitch Comparison.

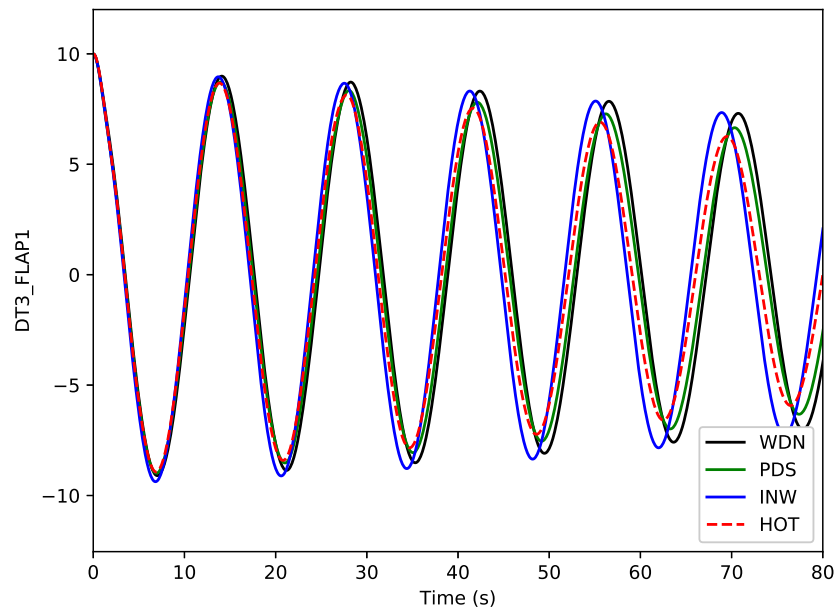


Figure 15: Decay Tests: DT3 Flap 1 Pitch Comparison (zoomed).

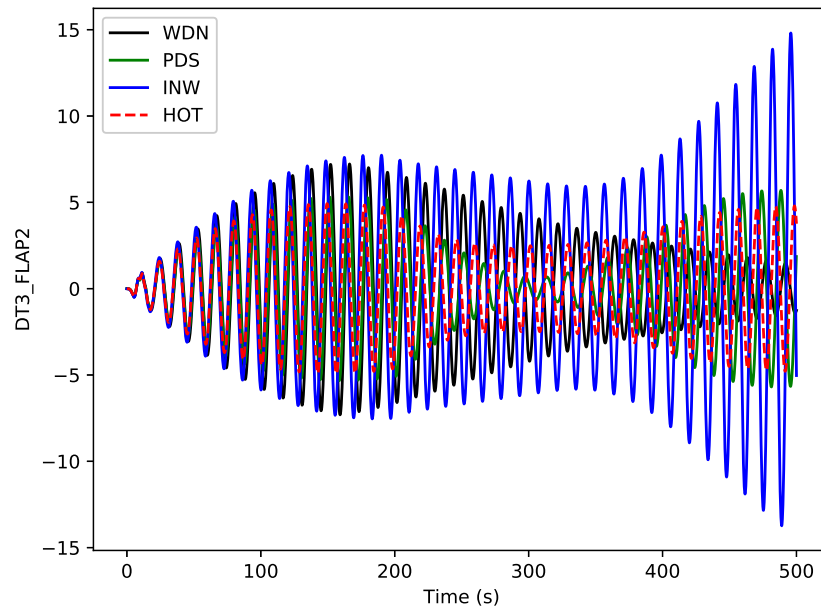


Figure 16: Decay Tests: DT3 Flap 2 Pitch Comparison.

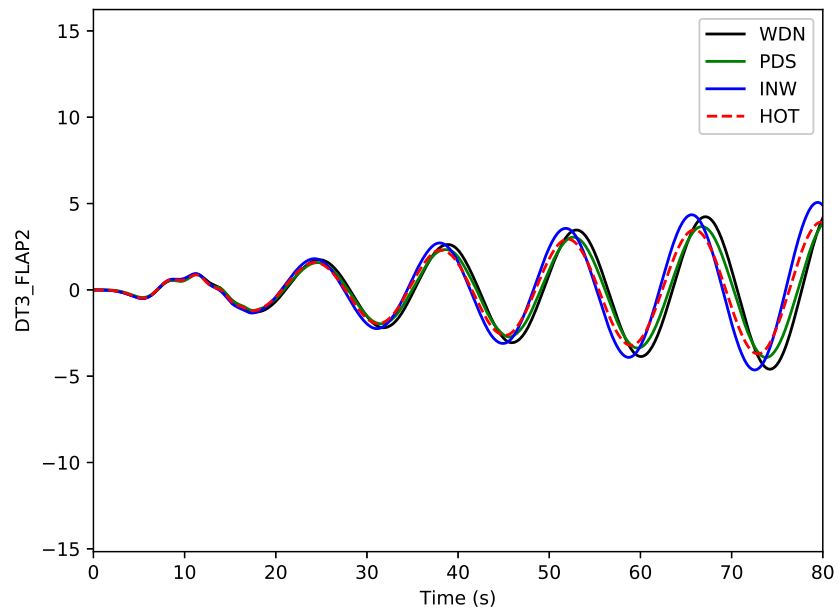


Figure 17: Decay Tests: DT3 Flap 2 Pitch Comparison (zoomed).

5 RAOs

5.1 Surge RAO

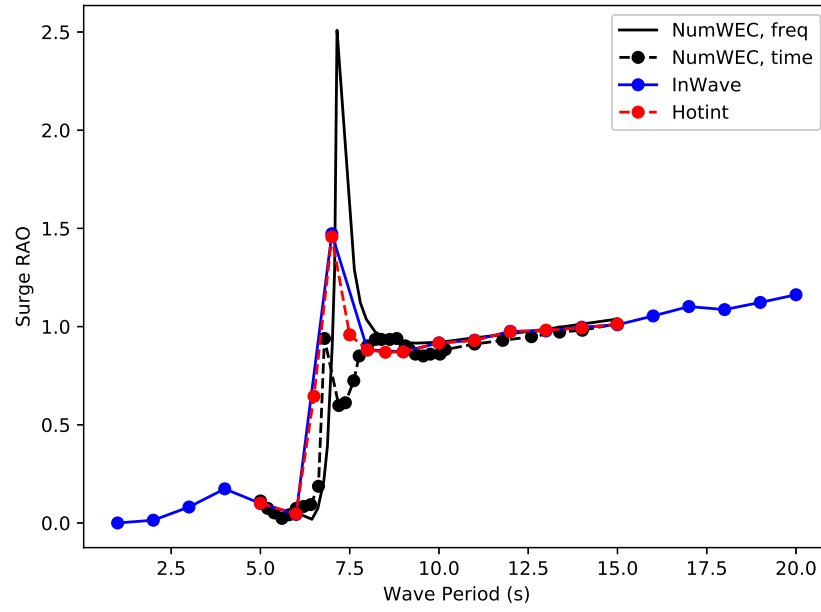


Figure 18: Surge RAO Comparison.

5.2 Heave RAO

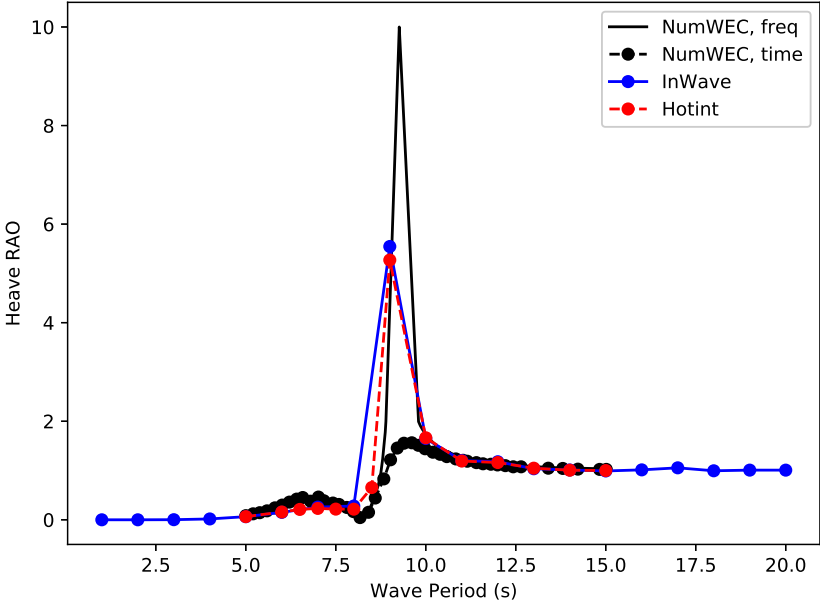


Figure 19: Heave RAO Comparison.

5.3 Pitch RAO

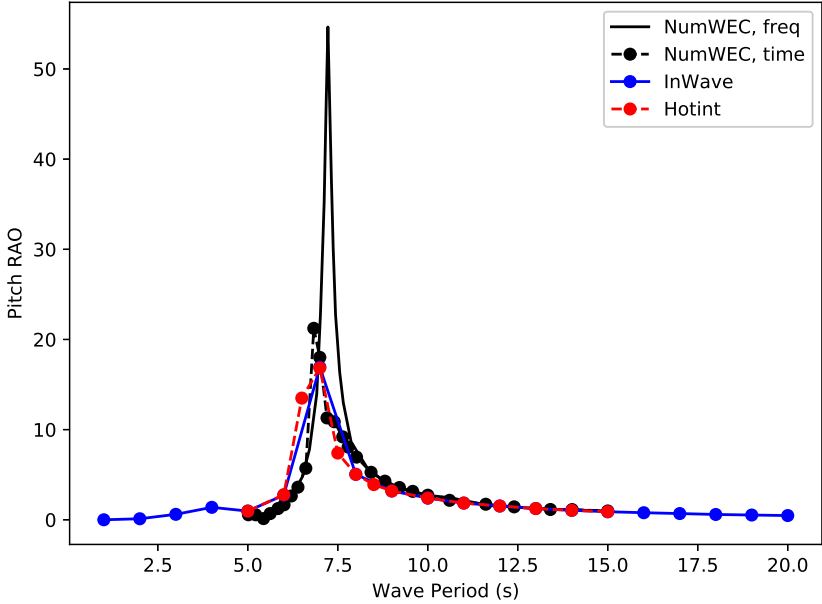


Figure 20: Pitch RAO Comparison.