NHP-WEC WP1:

Concept optimisation

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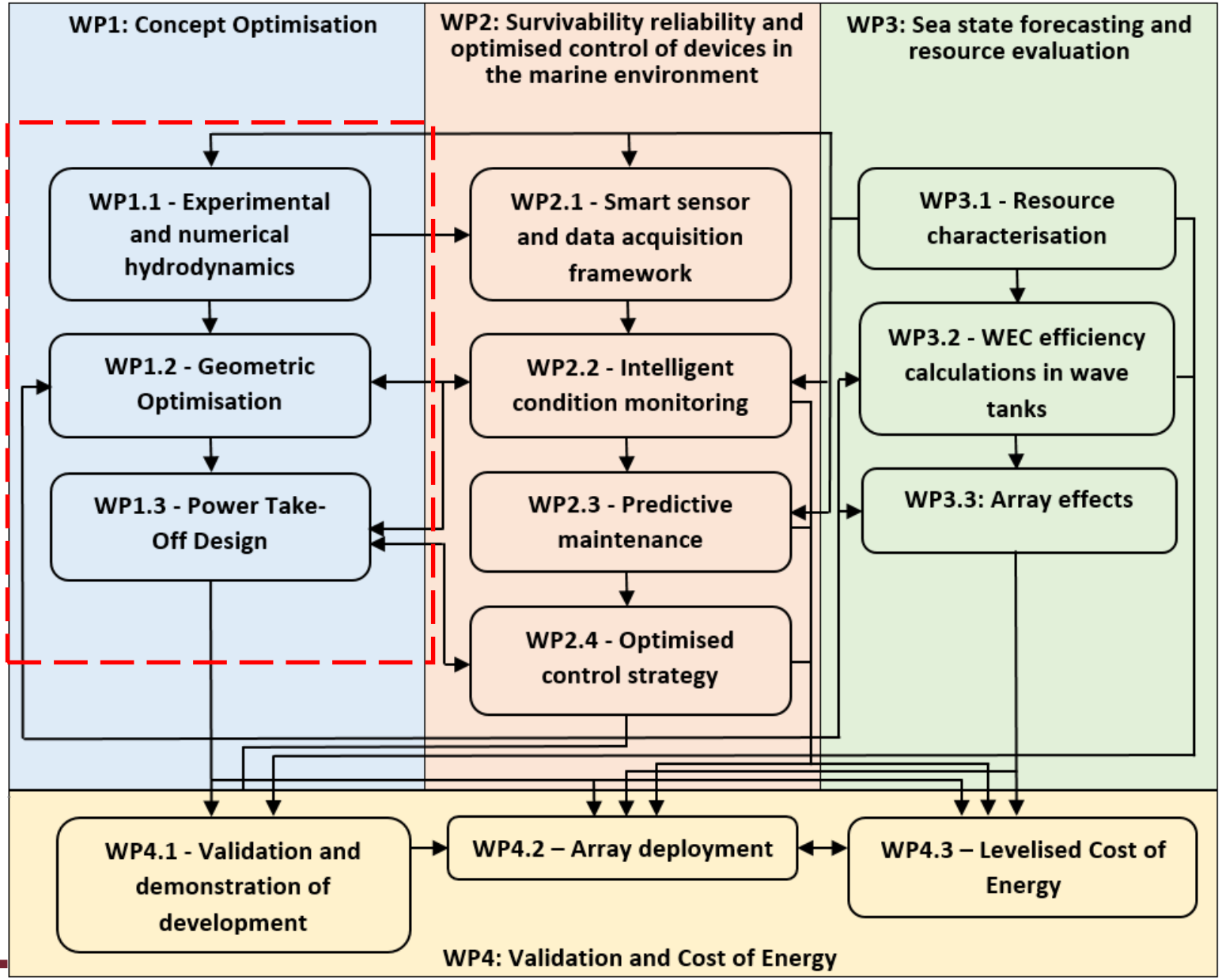


WP1

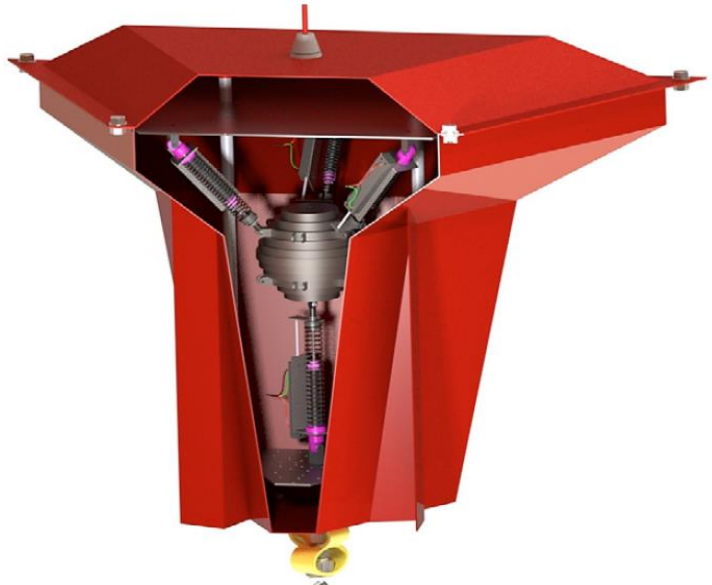
- WP 1.1- Experimental and numerical hydrodynamics
- WP 1.2- Geometric optimisation
- WP 1.3- Power take-off design

Introduction of TALOS WEC

Octagonal

TALOS I

Triangular



TALOS II

TALOS PTO test rig

- Multi-axis power take-off
- Fully enclosed system (PTOs…)

Paper 2: Time-domain implementation

An introduction of how to employ the open sources to implement time-domain modelling on multiple motion modes:

- Comparisons of the transformation from frequency domain and time domain (WAMIT vs. HAMS)
- the implementation of the time domain model of multiple motion modes, including:
  - ✓ Approximations of impulse functions
  - ✓ Approximation of the memory effects
  - ✓ The implementation and solution of the time-domain equation
- Provision of a method for checking the time-domain analysis

- ***Paper 2* 'Time-Domain Implementation and Analyses of Multi-Motion Modes of Floating Structures', *Journal of Marine Science and Engineering*, 2022**, 10, 662. https://doi.org/10.3390/jmse10050662 (open access, 13 May 2022)

Book publication

'Fundamentals of Wave Energy Conversions'

By Dr. Wanan Sheng and Prof. George Aggidis

published by Eliva Press

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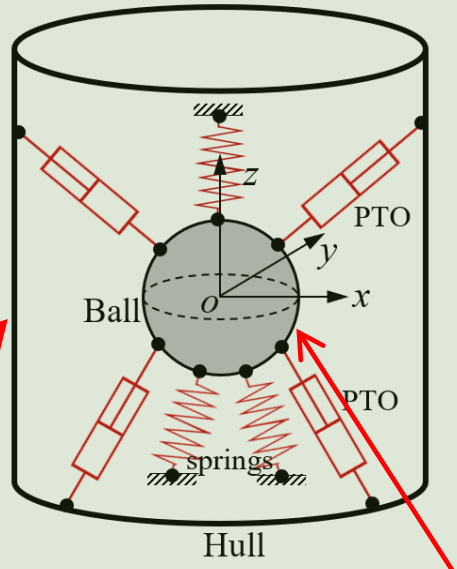
Fundamentals of Wave Energy Conversions

Time-domain modelling of TALOS WEC (ongoing work)

Equations for hull motion

$$
\begin{cases}
(m_s + A_{11})\ddot{x}_{s1}(t) + \sum_{j=1}^{6}\int_0^t K_{1j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s1}x_{s1}(t) = F_1^{exc}(t) - F_{pto1}(t) - F_{spr1}(t) \\
(m_s + A_{22})\ddot{x}_{s2}(t) + \sum_{j=1}^{6}\int_0^t K_{2j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s2}x_{s2}(t) = F_2^{exc}(t) - F_{pto2}(t) - F_{spr2}(t) \\
(m_s + A_{33})\ddot{x}_{s3}(t) + \sum_{j=1}^{6}\int_0^t K_{3j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s3}x_{s3}(t) = F_3^{exc}(t) - F_{pto3}(t) - F_{spr3}(t) \\
(I_{s44} + A_{44})\ddot{x}_{s4}(t) + \sum_{j=1}^{6}\int_0^t K_{4j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s4}x_{s4}(t) = F_4^{exc}(t) - M_{pto1}(t) - M_{spr1}(t) \\
(I_{s55} + A_{55})\ddot{x}_{s5}(t) + \sum_{j=1}^{6}\int_0^t K_{5j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s5}x_{s5}(t) = F_5^{exc}(t) - M_{pto2}(t) - M_{spr2}(t) \\
(I_{s66} + A_{66})\ddot{x}_{s6}(t) + \sum_{j=1}^{6}\int_0^t K_{6j}(t-\tau)\dot{x}_{sj}(\tau)d\tau + C_{s6}x_{s6}(t) = F_6^{exc}(t) - M_{pto3}(t) - M_{spr3}(t)
\end{cases}
$$



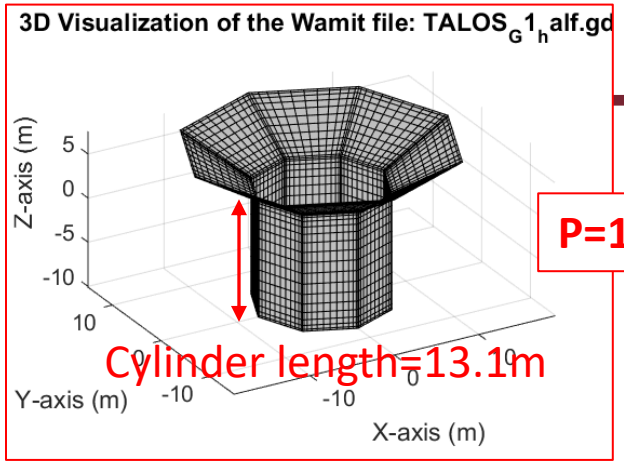
2-body system:
Hull + Ball

Equations for ball motion

$$
\begin{cases}
m_b\ddot{x}_{b1}(t) = F_{pto1}(t) + F_{spr1}(t) \\
m_b\ddot{x}_{b2}(t) = F_{pto2}(t) + F_{spr2}(t) \\
m_b\ddot{x}_{b3}(t) = F_{pto3}(t) + F_{spr3}(t) \\
I_{bxx}\ddot{x}_{b4}(t) = M_{pto1}(t) + M_{spr1}(t) \\
I_{byy}\ddot{x}_{b5}(t) = M_{pto2}(t) + M_{spr2}(t) \\
I_{bzz}\ddot{x}_{b6}(t) = M_{pto3}(t) + M_{spr3}(t)
\end{cases}
$$

Optimisations of TALOS WEC (initial studies)

V=3755m^3



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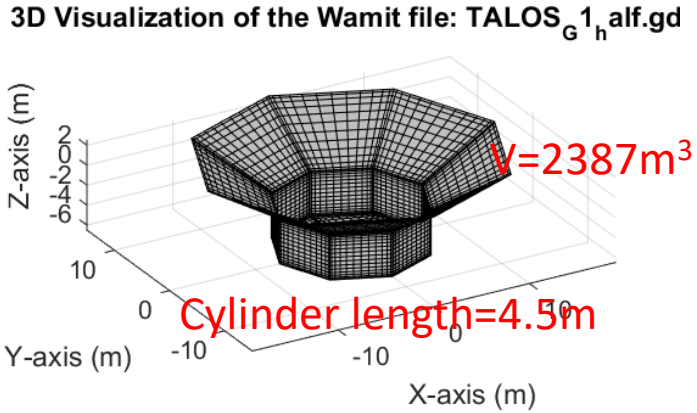

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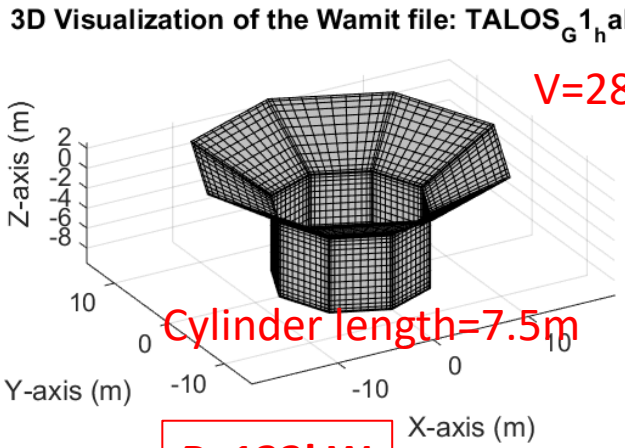

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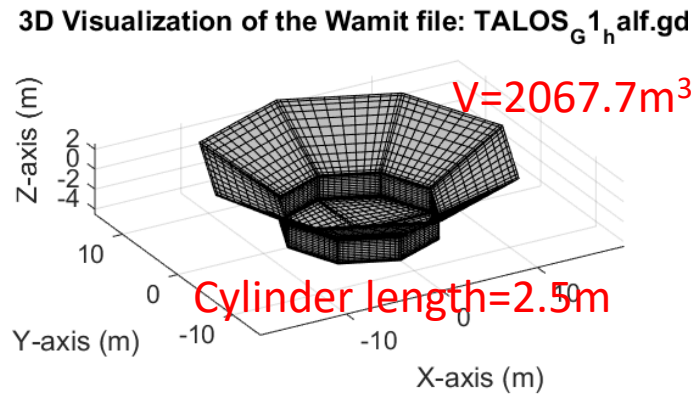

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ISOPE 2023 paper and collaborations

ISOPE 2023 paper:

Title: 'Hydrodynamic studies of TALOS WEC using different open source panel methods'

Wanan Sheng & George Aggidis

Collaborations:

- Time-domain model for TALOS optimisations (Hakan)
- TALOS hydrodynamic models for different wave climates
- TALOS hydrodynamics for control purposes
- And others

International collaborations

- National Renewable Energy Laboratory (NREL): a funding of $150,000 has been granted to support to use WEC-SIM to model TALOS wave energy converter.
- TALOS model testing in Zhejiang University (China): data sharing and comparison; proposed joint publications
- Hydrodynamics modelling (time-domain model using DNV SESAME software):
  - Dr. ***Constantine Michailides (***International Hellenic University)
  - Dr. ***Eva Loukogeorgaki*** (Aristotle University of Thessaloniki)
- And others

Future work

- Optimisations of the TALOS structure; of the PTOs (and springs)
- TALOS Model design and manufacture
- PTO consideration and design for model testing
- Work with **WP2**: to provide information for control studies
- Work with **WP3**: to examine the yearly outputs of energy extraction by TALOS
- Work with **WP4**: to validate and study the cost of energy…
- Paper preparations: (hydrodynamics studies; implementation of TALOS WEC, joint papers etc)
- And more…