Mid-year-presentation

PGR progression

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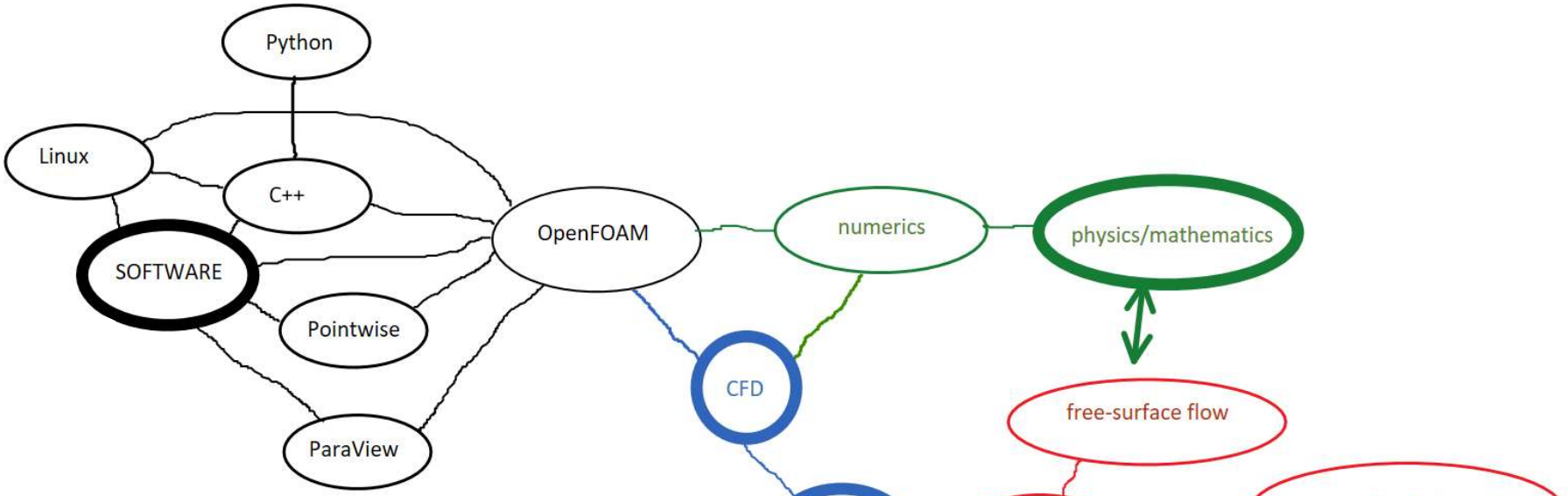
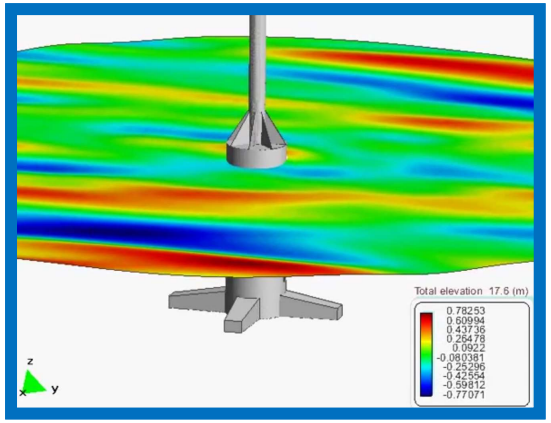
Internal ResIn meeting, Exeter – 07/02/2018

Presentation overview

- Objectives and key elements
- Progress and activity to date
- Initial findings
- Further plans

Objectives and key elements





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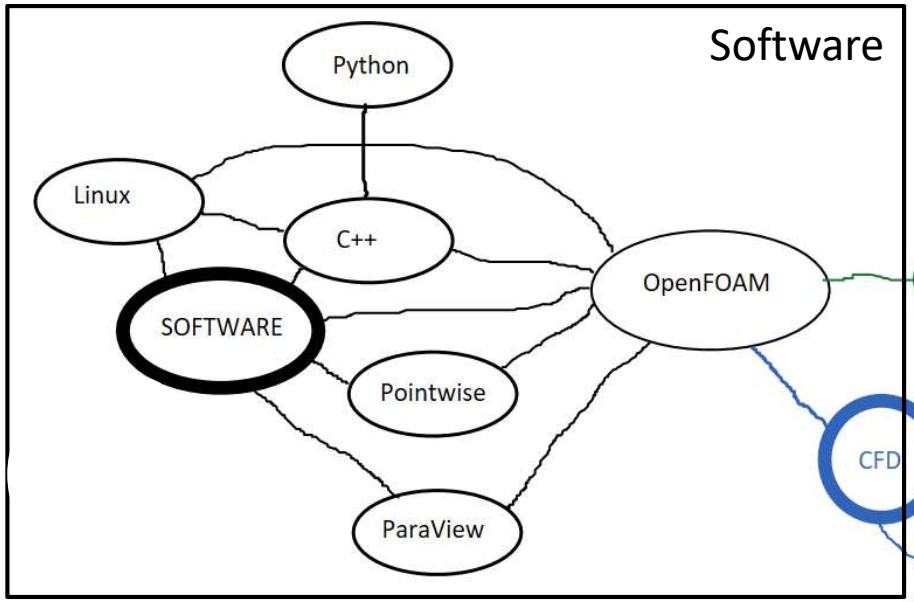

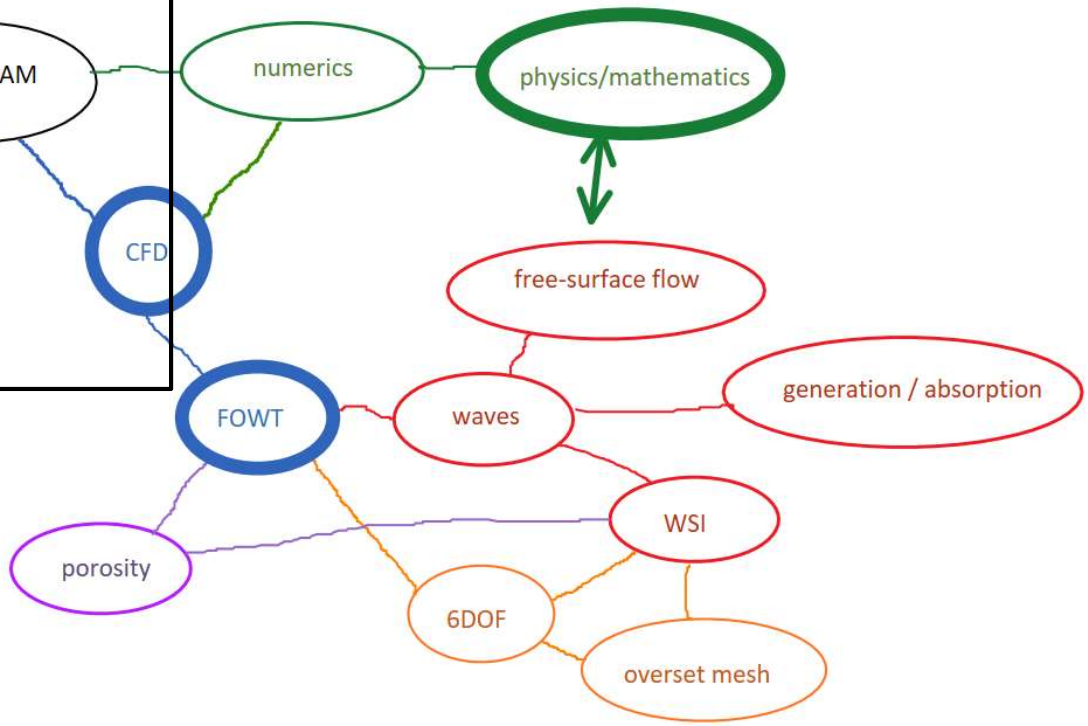

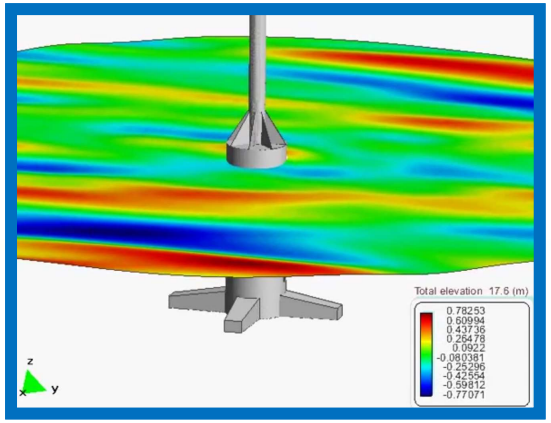

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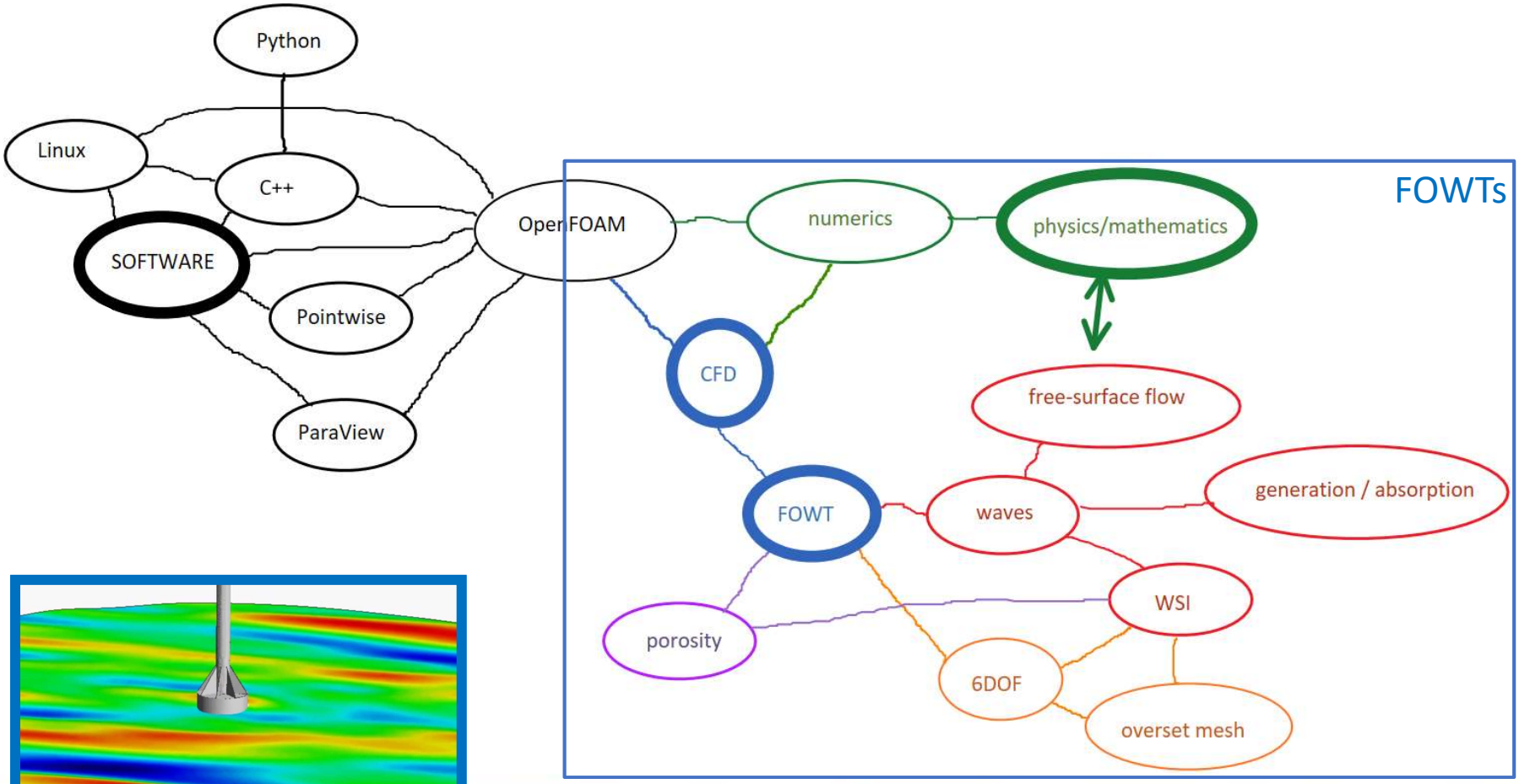

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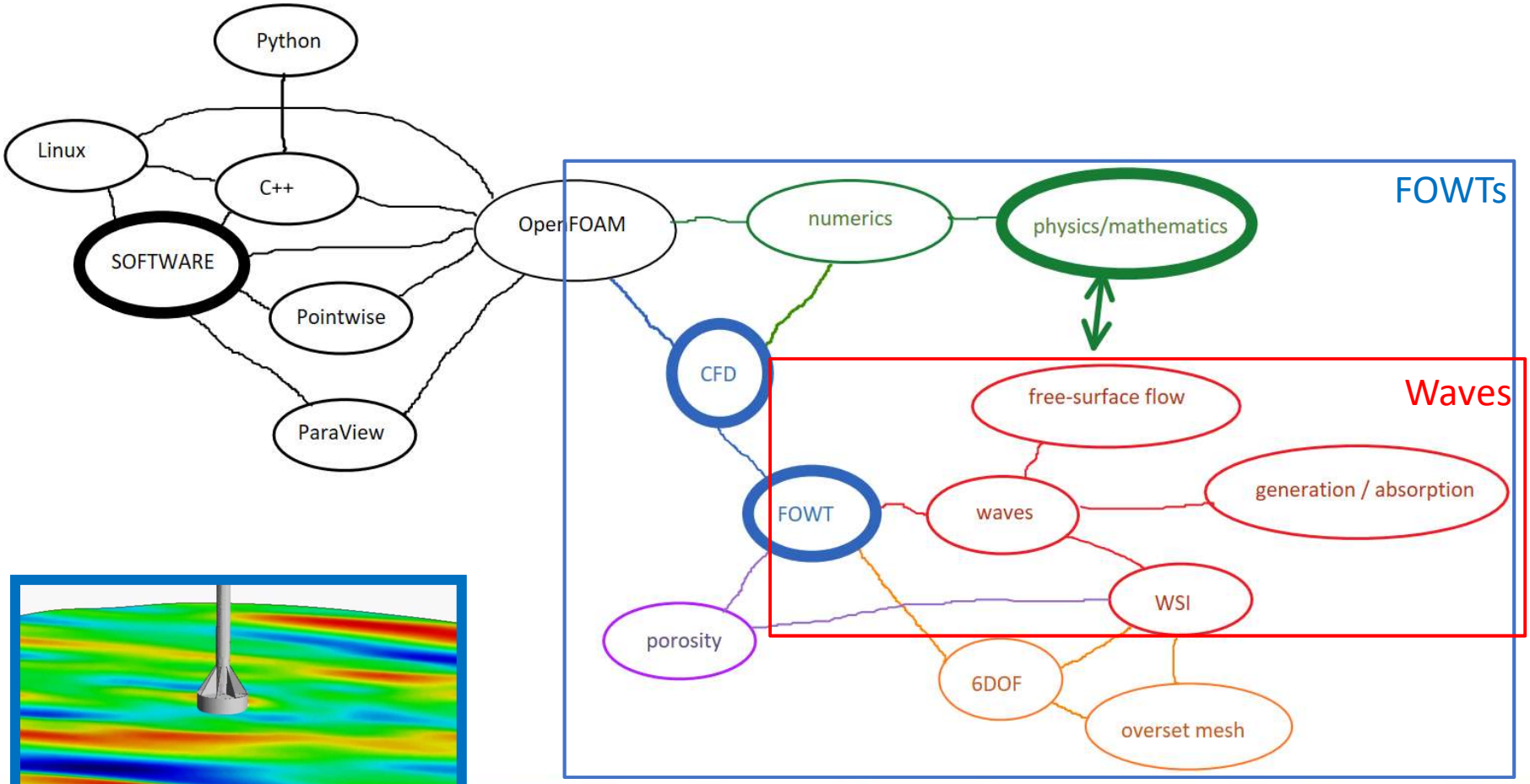
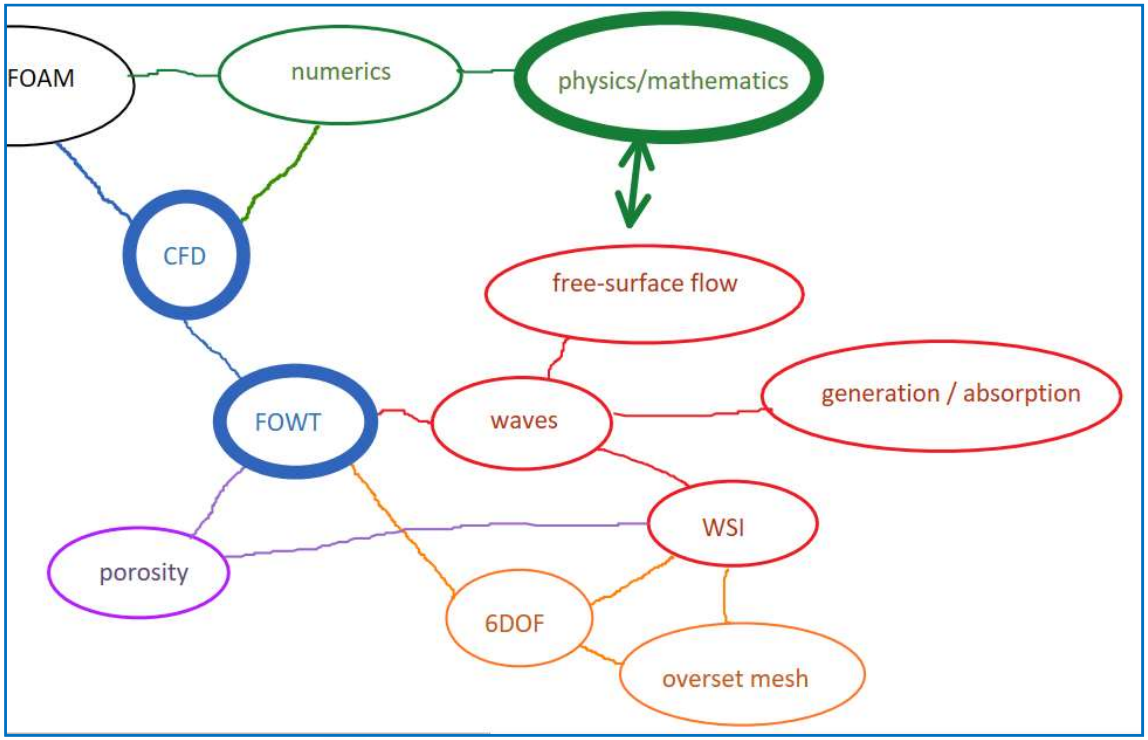


FOWTs with CFD

1. Wave generation and absorption
2. Porous structures
3. Motion (6DOF)



Coupled Simulations of FOWTs

- Prime focus
  - Floating substructure
  - Turbine
- Various simplifications
  - Mooring lines
  - Rotor
  - Turbulence
  - Platform motion
- Wave modelling
  - Regular, irregular, extreme,…
  - Damping method
- Validation
  - Experiments
  - Potential-flow theory and Morison's equation (FAST)

(Nematbakhsh (2013), Nematbakhsh et al. (2015), Quallen et al. (2014, 2016), Ren et al. (2015), Rivera-Arreba (2017), Tran et al. (2014, 2015, 2016, 2017) and others…

Modelling waves (Jasak et al. (2014), Schmitt et al. (2015), Windt et al. (2017))

- Wavemaker-waves
  - Dynamic boundary
  - Static boundary
- Artificial waves
  - Mass source
  - Momentum source
  - Relaxation zone method
- Absorption
  - Passive
  - Active

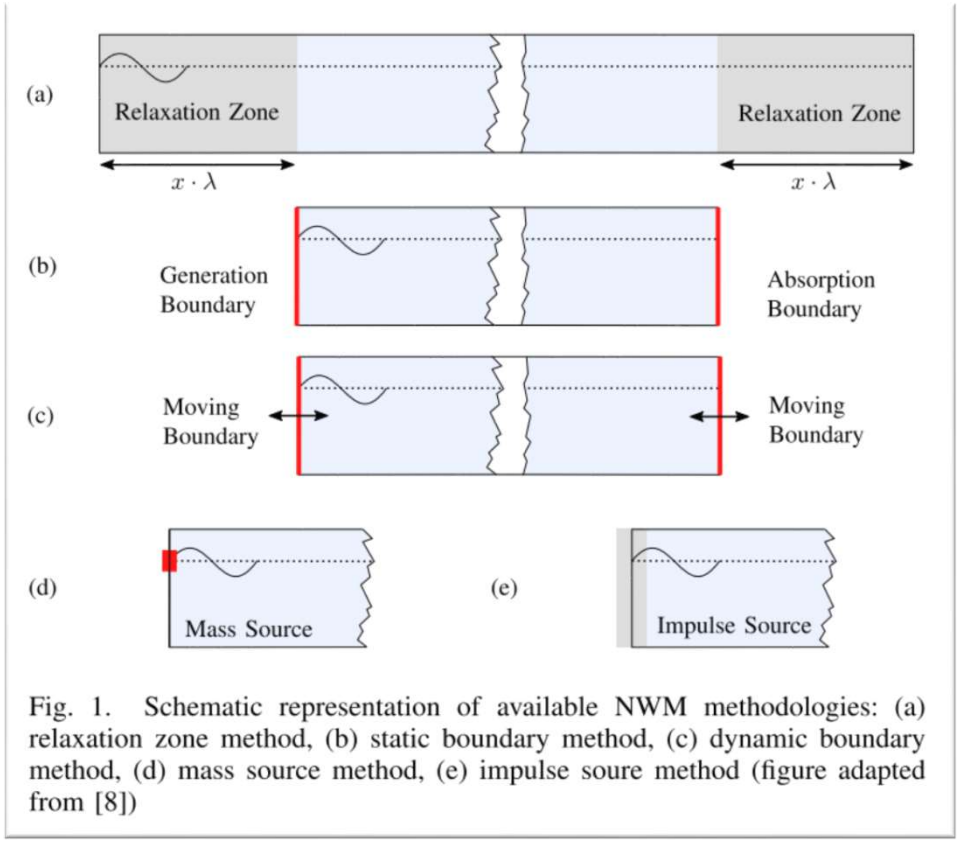


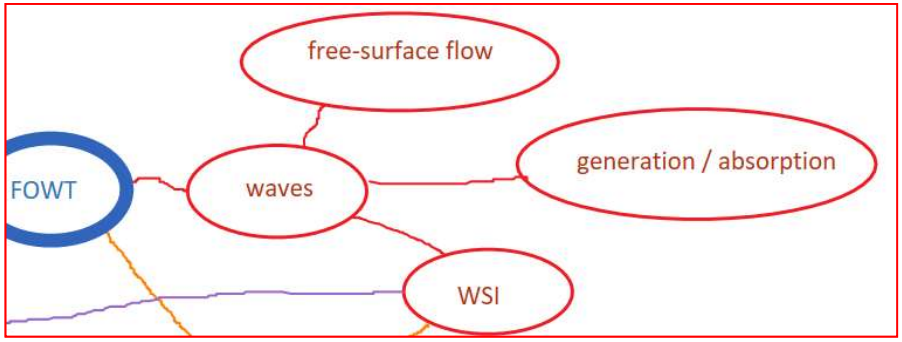
Fig. 1. Schematic representation of available NWM methodologies: (a) relaxation zone method, (b) static boundary method, (c) dynamic boundary method, (d) mass source method, (e) impulse soure method (figure adapted from [8])

(Windt et al. (2017))

Waves in OpenFOAM

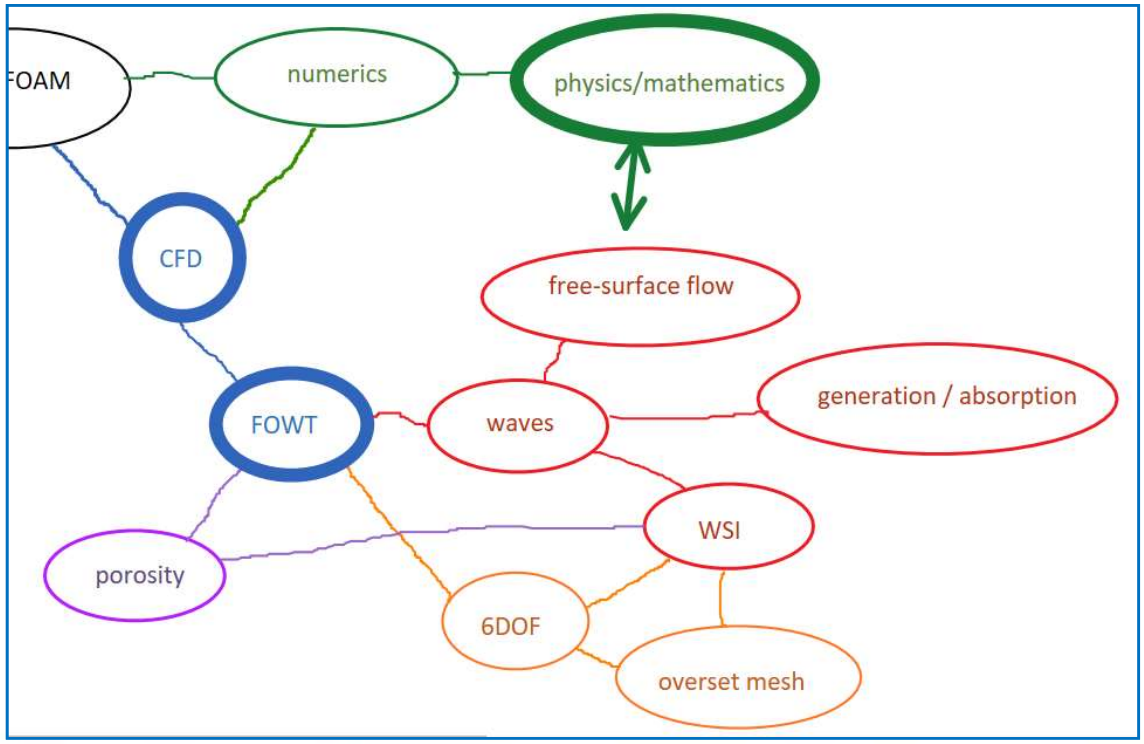
- swak4Foam (openfoamwiki.net)
  - To create arbitrary BCs with mathematical expressions
  - No absorption
- waves2Foam (Jacobsen et al. (2011), Jacobsen (2017)
  - Toolbox for wave generation and absorption
  - Passive wave relaxation zone method
- olaFlow (Higuera et al. (2012,2013,2014)
  - Toolbox for wave generation and absorption
  - Active absorption technique

- CFD Direct framework (since May 2017) (cfd.direct)
  - Inlet BCs
  - Wave Initialisation
  - Passive vertical wave damping at outlet



What to do next

- Wave modelling
  - Various toolboxes
  - 2D
  - 3D
  - WSI (fixed structure)
- Porosity implementation
- Motion → overset mesh
  - Imposed motion
  - Floating



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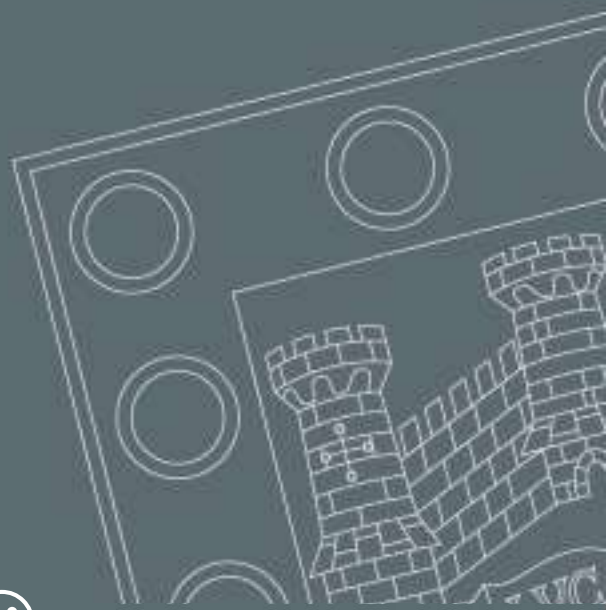

Thank you for your attention ☺

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