# REEF3D : Open-Source Hydrodynamics

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www.reef3d.com



# Numerical wave modeling

[SINTEF]



#### **Spectral Wave Model**

- large scalea
- phase averaged



#### **Boussinesq Wave Model**

- large scale
- phase resolved

#### **Numerical Wave Tank**

8.687

- near field
- flow resolving

 $U_x$ 

2.500 5.000

- CFD (Computational Fluid Dynamics), solving Navier-Stokes equations

### Numerical Wave Tank



## Wave Input

#### **Solitary Waves**

- 1st-order
- 3rd-order

#### **Regular Waves**

- shallow water
- intermediate water
- deep water
- 2nd-order Stokes
- 5th-order Stokes
- shallow water cnoidal
- 1st-order cnoidal
- 5th-order cnoidal

#### **Irregular Waves**

- 1st-order irregular
- 1st-order focussed
- 2nd-order irregular
- 2nd-order focussed **spectra** 
  - PM
  - JONSWAP
  - Torsethaugen

#### Wavemaker

- Piston
- Flap

# Wave interaction with combined submerged and floating breakwater



# Wave interaction with combined submerged and floating breakwater



## Bølge interaksjon med porøs konstruksjoner



## Bølge interaksjon med moloer



#### Pressure



# Breaking wave forces: Setup



- Experiments: GWK (Irschik et al. 2002)
- H=1.30 m
- T=4.0 s
- D=0.7 m
- 15 million cells



## Breaking wave forces



### Breaking wave forces: Comparison



## Comparison of Impact Forces



### Floating objects in waves



#### Landslide events generating extreme waves



## Sediment Transport

- Bed: Interface between Water and Solid
- level set function: Implicit Topology Technique
- Van Rijn: Bedload and Suspended Load
- external velocity gradient from sediment concentration gradient



## Pipeline Scour Current



## Pipeline Scour



### Seawall scour



# Large scale wave modeling with natural topography

#### **Prosedyre:**

- Points P(x,y,z)
- Inverse Distance or Kriging Interpolation
- Level Set Function for topography







# Large scale wave modeling with natural topography





# Large scale wave modeling with natural topography



# Large scale wave modelling with natural topography



# Large scale wave modelling with natural topography



# Wave transmission across a submerged bar+ floating breakwater



## Masters thesis opportunity

## Sediment transport under waves and current



### Masters thesis opportunity

### Multi scale wave modelling for the E39 project

![](_page_25_Figure_2.jpeg)

![](_page_25_Picture_3.jpeg)

![](_page_25_Picture_4.jpeg)

## Masters thesis opportunity

# Numerical modelling of floating objects and mooring

![](_page_26_Picture_2.jpeg)