UNIVERSITÀ DI PARMA

NJIT New Jersey Institute of Technology

# *"New paradigms for variable resolution in SPH"*

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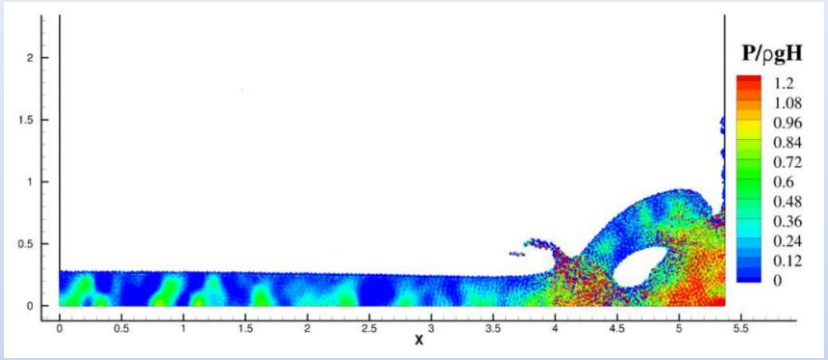
# Smoothed Particle Hydrodynamic Method

**Engineering Applications:**

- Fluid Dynamics: Free-surface flows (e.g. Coastal Engineering problems, shloshing in tanks)
- Astrophysics
- Solid mechanics



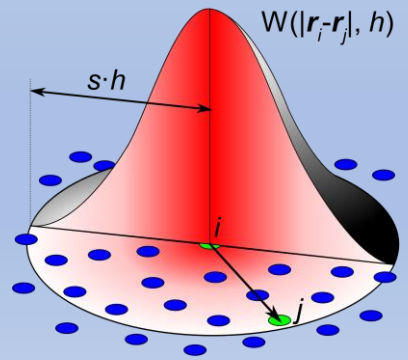

## SPH interpolation operators:

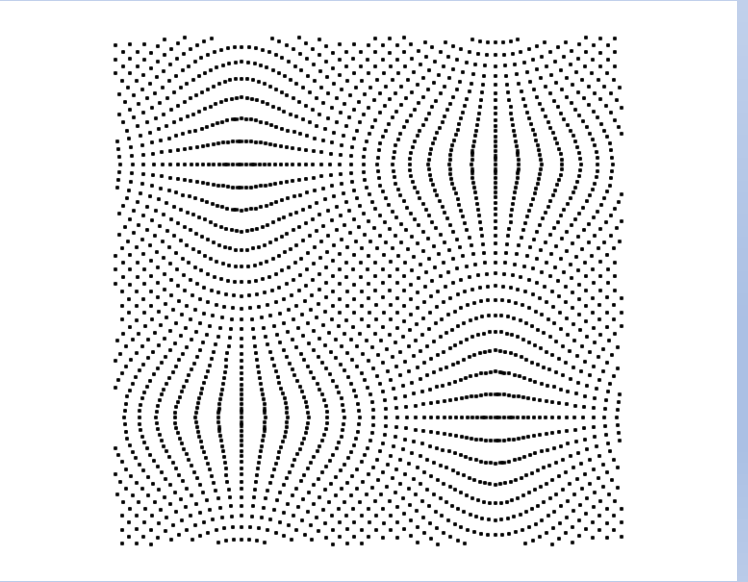
**Continuous:**

$$F(\boldsymbol{r},t) = \int_{\Omega_r} F(\boldsymbol{r}',t)W(\boldsymbol{r}-\boldsymbol{r}',h)d\boldsymbol{r}'$$

**Discrete:**

$$F(\boldsymbol{r},t) = \sum_b F(\boldsymbol{r}',t)W(\boldsymbol{r}-\boldsymbol{r}')V_b$$



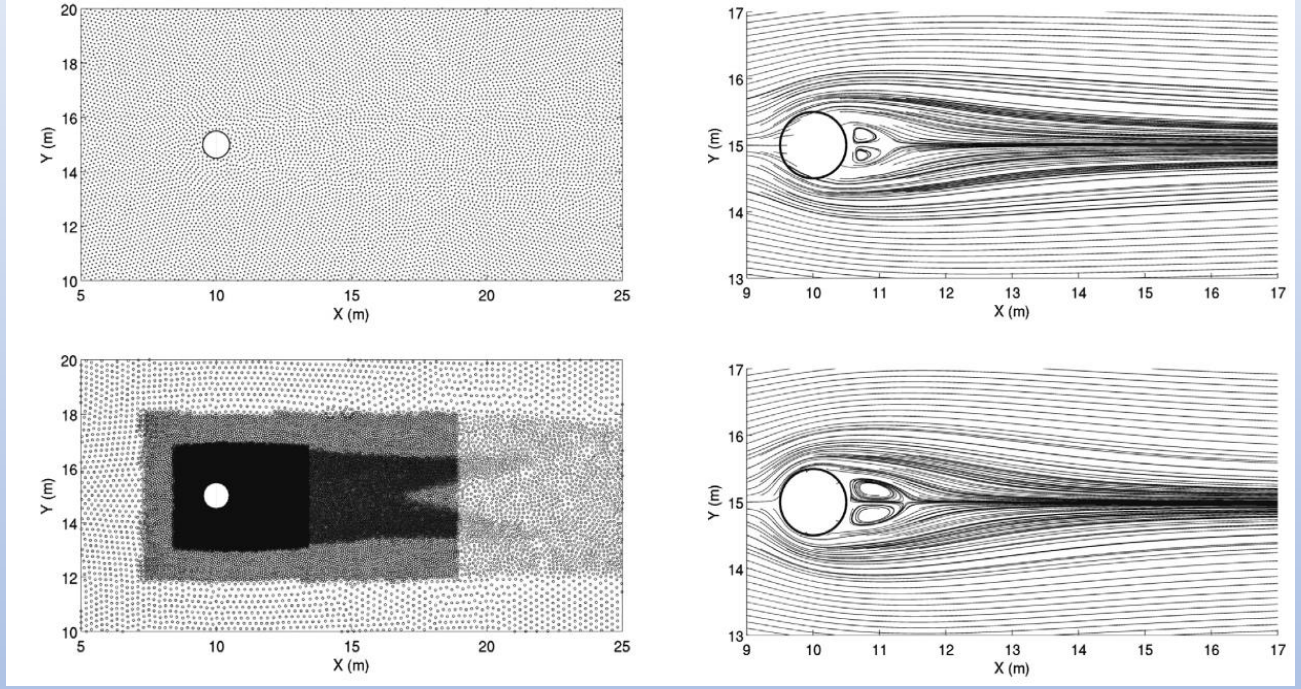
# Research Topic: Variable Resolution within the SPH Method

**Variable resolution in SPH:**

- Increase accuracy in region of interest (e.g. high-gradient , near-wall regions)
- Small increase of the computational cost (No uniform resolution)
- Increase the range of applicability of the SPH method to multi-scale engineering problem

**Challenges:**

- SPH is a Lagrangian Meshless method
- No topological structure
- Stability of the method
- Implementation within HPC framework(Gpus, Multi-Cpus)




Vacondio, Renato, et al. "Variable resolution for SPH: a dynamic particle coalescing and splitting scheme." *Computer Methods in Applied Mechanics and Engineering* 256 (2013): 132-148.