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ADVANCED ENGINEERING APPLICATIONS OF FLUID-STRUCTURE INTERACTION (FSI) WITH SPH

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ABSTRACT

Smoothed Particle Hydrodynamics (SPH) has long promised to revolutionise the simulation of fluid mechanics with natural application to free-surface hydrodynamics and fluid-structure interaction (FSI). Particular successes have been achieved for applications such as wave energy converters, ocean and coastal engineering, biomedical engineering, automotive applications, etc. However, key challenges remain. The SPH community is successfully addressing some of the underlying fundamental issues [1, 2] but more effort is essential. This session will cover the range of topics currently under intense development covering boundary conditions, key physical processes such as hydroelasticity, multi-phase formulations, variable resolution, mixed formulations and wicked applications from industry.

Considered to be at a "tipping point" by industry for its application, the objectives of this session are as follows:

- Identify current state-of-the-art for simulating FSI with SPH
- Demonstrate the major areas of success
- Identify the major underlying issues preventing greater uptake and what SPH is currently doing to address them
- Understand the challenges involved in developing and using multi-scale approaches either through variable resolution or coupling codes operating on different scales
- Identify current challenges of formulations and computing resources including multi-phase physics and high-performance computing (e.g. multi-GPU)
- Identify the forthcoming challenges
- Identify how the SPH community can address current issues
- Identifying key steps to encourage uptake by industry.

We plan to attract approximately 6-12 contributions.

REFERENCES (Not mandatory, maximum 2 references)

[1] Khayyer, A., Gotoh, H. and Shimizu, Y. 2022 "On systematic development of FSI solvers in the context of particle methods.", *Journal of Hydrodynamics*, 34:395-407. https://doi/org/10.1007/s42241-022-0042-3.

[2] Vacondio, R., C. Altomare, M. De Leffe, X. Y. Hu, D. Le Touze, S. Lind, J. C. Marongiu, S. Marrone, B. D. Rogers, and A. Souto-Iglesias. 2021. "Grand challenges for Smoothed Particle Hydrodynamics numerical schemes.", *Computational Particle Mechanics* 8(3):575-88, https://doi.org/10.1007/s40571-020-00354-1.