Renewal Proposal for a XSEDE Allocation on the Supercomputer

Stampede2 at TACC

Fully resolved simulations of passive and active particles in fluid flows

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References

- [1] A. Alsinan, E. Meiburg, and P. Garaud. Fingering convection in double-diffusive, sediment-laden flows: linear stability analysis. *J. Fluid Mech.*, in preparation, 2016.
- [2] E. Biegert, B. Vowinckel, and E. Meiburg. Grain-resolving simulations of flows over dense, mobile, multidisperse granular sediment beds: An immersed boundary approach. J. Comp. Phys., submitted:DOI: arXiv:1608.03566, 2016.
- [3] J. R. Blake. A spherical envelope approach to ciliary propulsion. *Journal of Fluid Mechanics*, 46(1):199–208, 03 1971.
- [4] N. G. Chisholm, D. Legendre, E. Lauga, and A. S. Khair. A squirmer across reynolds numbers. *Journal of Fluid Mechanics*, 796:233256, 2016.
- [5] J. H. Ferziger and M. Peric. Computational methods for fluid dynamics. Springer Science & Business Media, 2012.
- [6] T. Ishikawa, M. P. Simmonds, and T. J. Pedley. Hydrodynamic interaction of two swimming model micro-organisms. *Journal of Fluid Mechanics*, 568:119160, 2006.
- [7] P. Y. Julien. Erosion and sedimentation. Cambridge University Press, 2010.
- [8] T. Kempe and J. Fröhlich. An improved immersed boundary method with direct forcing for the simulation of particle laden flows. *J. Comput. Phys.*, 231(9):3663–3684, 2012.
- [9] A. G. Kidanemariam and M. Uhlmann. Formation of sediment patterns in channel flow: minimal unstable systems and their temporal evolution. *Journal of Fluid Mechanics*, 818:716–743, 2017.
- [10] B. Kneller, M. M. Nasr-Azadani, S. Radhakrishnan, and E. Meiburg. Long-range sediment transport in the world's oceans by stably stratified turbidity currents. *Journal of Geophysical Research: Oceans*, 2016.

- [11] N. Konopliv and E. Meiburg. Double-diffusive lock-exchange gravity currents. J. Fluid Mech., 797:729–764, 2016.
- [12] N. Konopliv, S. G. L. Smith, J. McElwaine, and E. Meiburg. Modelling gravity currents without an energy closure. *Journal of Fluid Mechanics*, 789:806–829, 2016.
- [13] R. S. Lampitt, E. P. Achterberg, T. R. Anderson, J. A. Hughes, M. D. Iglesias-Rodriguez, B. A. Kelly-Gerreyn, M. Lucas, E. E. Popova, R. Sanders, J. G. Shepherd, D. Smythe-Wright, and A. Yool. Ocean fertilization: a potential means of geoengineering? *Philosophical transactions. Series A, Mathematical, physical, and engineering sciences*, 366(August):3919–3945, 2008.
- [14] G. Li, A. Ostace, and A. M. Ardekani. Hydrodynamic interaction of swimming organisms in an inertial regime. *Phys. Rev. E*, 94:053104, Nov 2016.
- [15] W. Lick, L. Jin, and J. Gailani. Initiation of movement of quartz particles. *Journal of Hydraulic Engineering*, 130(8):755–761, 2004.
- [16] M. J. Lighthill. On the squirming motion of nearly spherical deformable bodies through liquids at very small reynolds numbers. Communications on Pure and Applied Mathematics, 5(2):109–118, 1952.
- [17] A. J. Mehta, E. J. Hayter, W. R. Parker, R. B. Krone, and A. M. Teeter. Cohesive sediment transport. i: Process description. *Journal of Hydraulic Engineering*, 115(8):1076–1093, 1989.
- [18] E. Meiburg and B. Kneller. Turbidity currents and their deposits. *Annu. Rev. Fluid Mech.*, 42:135–156, 2010.
- [19] F. Necker, C. Härtel, L. Kleiser, and E. Meiburg. High-resolution simulations of particle-driven gravity currents. *Int. J. Multiphase Flow*, 28(2):279–300, 2002.
- [20] R. Nokes, C. Cenedese, M. Ball, and T. Williams. The front condition for gravity currents propagating over rough boundaries. In *VIIIth International Symposium on Stratified Flows*, volume 1, 2016.
- [21] C. Santarelli, T. Kempe, and J. Fröhlich. Immersed boundary methods for heat transfer. *International Journal of Numerical Methods for Heat & Fluid Flow*, 26(2):504–514, 2016.
- [22] J. E. Simpson. Gravity currents: In the environment and the laboratory. Cambridge university press, 1997.
- [23] S. Te Slaa, D. van Maren, Q. He, and J. Winterwerp. Hindered settling of silt. *Journal of Hydraulic Engineering*, 141(9):04015020, 2015.
- [24] M. Uhlmann. An immersed boundary method with direct forcing for the simulation of particulate flows. J. Comput. Phys., 209(2):448–476, 2005.
- [25] B. Vowinckel, R. Jain, T. Kempe, and J. Fröhlich. Erosion of single particles in a turbulent open-channel flow: a numerical study. *J. Hydraul. Res.*, submitted, 2016.
- [26] B. Vowinckel, T. Kempe, and J. Fröhlich. Fluid-particle interaction in turbulent open channel flow with fully-resolved mobile beds. Adv. Water Res., 72:32–44, 2014.
- [27] M. S. Yalin and E. Karahan. Inception of sediment transport. *Journal of the hydraulics division*, 105(11):1433–1443, 1979.