# Regular or random: A discussion on SPH initial particle distribution

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## ABSTRACT

In recent years, Smoothed Particle Hydrodynamics (SPH) has been used to model a variety of objects and for a number of applications in engineering and science. Much research has been dedicated to forming a better understanding of the SPH method. As a consequence, new numerical techniques have been developed in order to overcome some of its difficulties and limitations. Nonetheless, there is still a gap in information concerning the impact of the initial particle distribution on the effectiveness of the SPH method. With this in mind, a thorough review of existing recommendations for SPH initial configurations has been conducted in this paper. In addition to this, a numerical example is presented which is based on the classical 2-D lid driven cavity problem, wherein the upper boundary exerts a horizontal shear force on the fluid inside the cavity. The velocity of the lid is $v_l = 10^{-3}$ m/s and the cavity is square with length $l = 1\times10^{-3}$ m. The fluid was modelled with a density $\rho = 1000$ kg/m$^3$, a viscosity $\mu = 10^{-3}$ kg/(ms) (Re = 1). These parameters were held constant for all consequent comparisons. The number of particles is varied from (20 × 20) to (80 × 80). The initial distribution is modelled in three different ways: (i) regular, (ii) pseudo-regular (with a 30% random deviation from the regular grid) and (iii) fully random. The effectiveness of each initial particle distribution is assessed according to the field velocites and horizontal and vertical centreline velocity profiles. A reference particle distribution is obtained by comparing against the CFD results. The impact of the initial particle distribution is highlighted and compared, and recommendations and conclusions are drawn for the SPH method.

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