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The Sparse Cardinal Sine Decomposition (SCSD) and its application to the simulation of suspensions.

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For many applications (settling, transport...), it is necessary to compute the flow of either dilute or concentrated unbounded suspensions made of solid particles immersed in a Newtonian liquid. For small enough particles, the flow Reynolds number vanishes and the task fortunately reduces to the treatment of the linear Stokes equations [1]. This can be efficiently achieved by solving boundary-integral equations [2].

However, as usual in such formulations, the discretization of the problem leads to dense and non-symmetric linear systems whose size grows as the square of the number of particles. Acceleration techniques are therefore usually employed. Most of them are based on the compression of the underlying matrix in order to obtain efficient matrix vector products (see e.g. Fast Multipole Method, $\mathcal{H}$-matrices, etc.). In this direction, the new Sparse Cardinal Sine Decomposition method (SCSD) was recently developed for the scalar kernel encountered in acoustics [3]. The main idea consists in expanding the kernel in the Fourier space as a finite sum of Cardinal Sine functions. The method has been further extended to the vectorial Stokes kernel in [4] where it has actually been implemented and tested for a single solid particle.

After presenting the SCSD solver for the Stokes kernel, this work investigates its ability to efficiently cope with N-particle clusters immersed in a Newtonian liquid. Cases of large N will be investigated. Both distant or close (packed) particles will be considered.

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