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Autore	Chan-Braun Clemens
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Sommario/riassunto	This thesis aims to contribute to a better understanding of turbulent open channel flow, sediment erosion and sediment transport. The thesis provides an analysis of high-fidelity data from direct numerical simulation of (i) open channel flow over an array of fixed spheres, (ii) open channel flow with mobile eroding spheres, (iii) open channel flow with sediment transport of many mobile spheres. An immersed boundary method is used to resolve the finite-size particles.