

MODELING FLOCCULATION PROCESSES: CONTINUOUS PARTICLE SIZE DISTRIBUTION METHOD

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The flocculation process of cohesive sediment suspended in water consists of aggregation of the fine particles and breakup of the large flocs. The population balance equation (PBE) is a statement of continuity for particulate systems, and it is used to model the flocculation process and predict the particle size distribution (PSD). Different numerical methods are developed to solve the PBE, however most of the methods have difficulties in representing the continuous PSD or improving computational efficiency. In this research, the B-spline FEM and Galerkin FEM are studied to simulate the continuous PSD. The B-spline FEM solves the PBE over the whole domain, which is truncated to finite domain; the open non-uniform B-splines are used as basis function to approximate the PSD; the curve of PSD is required to be smooth enough. The Galerkin FEM discretizes the PBE on each sub-domain (the whole domain is split to several sub-domains), and it is used to solve less-smooth problems. The adaptive technique is applied to readjust the computational grid (particle size domain) to improve computational efficiency and the accuracy, and it is also applied in varied time step to get suitable time step to improve the stability. The analytical solutions of the PBE in special conditions and the experimental data are used to validate both B-spline FEM and Galerkin FEM, and the results are compared with that of the classical DPBE method. It shows that both B-spline FEM and Galerkin FEM can solve the PBE and simulate continuous PSD accurately and efficiently.