FROM THE EDITOR

This issue of TASK Quarterly includes 15 scientific contributions dealing with silo problems.

The problems characteristic to silo flow belong to the oldest ones in the field of mechanics of bulk solids. Phenomena such as quasi-static stress oscillations, dynamic stress pulsations, resonance effects, localization of deformations, bridges and arching, dust explosions and scale effects have not been explained to such extent that they can be fully controlled or systematically reduced. These problems are obviously very difficult to solve due to their discrete and stochastic character and great sensitivity of bulk solids to boundary conditions of the entire system. However, these are fascinating problems since they are closely related to similar problems occurring in many other domains: soil mechanics, powder technology, soil dynamics, physics and mechanical engineering. Recently, significant progress has been made in the field of theoretical description of silo flow. New elasto-plastic and hypoplastic constitutive laws for bulk solids have been developed within a continuum approach. They have been extended by polar rotations, non-local strain measures and deformation gradients to properly capture localisations of deformations. Simpler calibration procedures have been formulated. To simulate large deformations during full flow, a particle-in-cell approach was successfully used. At the same time, granular dynamic algorithms treating bulk solids as separate particles were also considerably improved with regard to the simulation of grain shape and identification of material parameters. However, in spite of this progress, our knowledge of silos is highly unsatisfactory. Silo loads during flow are still calculated with the old theory formulated by Janssen for filling, the shape of silos has not changed for years, a predicted critical silo opening to avoid arching varies greatly and the silo industry has continuous problems in properly handling bulk solids. Hundreds of industrial and farm silos, bins and hoppers still experience a degree of failure each year, so that the failure rate of silos is significantly higher than those of other engineering structures.

The papers have been prepared by scientists who deal, both theoretically and experimentally, with silo problems in Australia (Newcastle), Germany (Braunschweig, Karlsruhe, Ludwigshafen), Norway (Porsgrunn), Great Britain (London), USA (Westword) and Poland (Bialystok, Gdansk, Lodz, Warsaw, Wroclaw).

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