**Title** Simulation of three-dimensional airflow in grain storage bins

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**Abstract**

A mathematical model and software were developed for the three-dimensional simulation of airflow through high capacity grain storage bins by considering the non-uniformity of the seed mass. To validate the proposed model, empirical relationships between air velocity and static pressure drop were obtained for compacted layers of several storage depths for soya bean, maize, rice and wheat mass. The software was written in ANSI C++ which is transferable to a variety of platforms. For the construction of 3D geometry and the generation of meshes free-of-charge software was used. The solver software generated a system of linear algebraic equations using the finite -element method. Three iterative processes were carried out: (1) calculation of a local permeability coefficient, using the pressure distribution in the immediately previous iteration step, (2) search for the system design point, located in the performance curve of the aerator fan, and (3) adaptation to refine the mesh. A local criterion to estimate the efficiency of complex aeration system in storage bins was proposed. The simulations showed good performance. It was considered that the method could be applied to optimise the performance of existing grain stores and lower the engineering costs of new grain stores.