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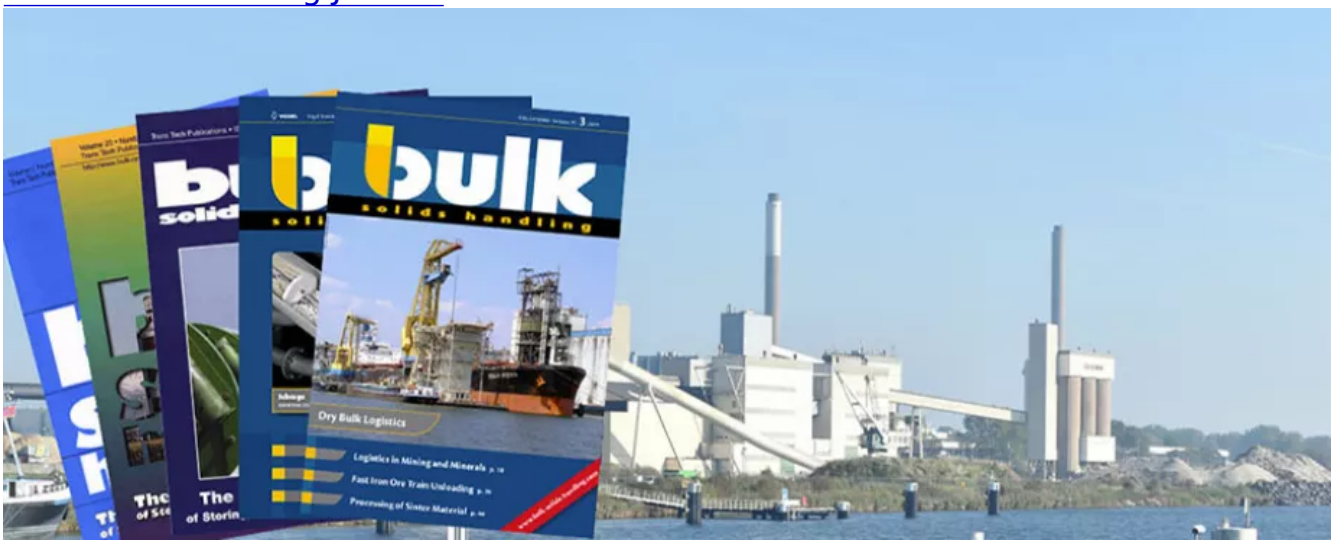

Fachartikel

Statistical Mechanical Considerations on Storing Bulk Solids

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A geometrical probability space for the stored bulk solids is introduced and the concept of bulk 'Voronoi Cells' is elaborated upon. The classical statistical mechanical theory and the Boltzmann's postulate is specialised to a large collection of bulk 'Voronoi Cells'. Exact probability density functions for the distribution of voids in stored bulk solids are then found. It is shown that the initial state of a stored bulk solid corresponds to a loose random storingstate for which the void space distribution is uniform throughout the bulk solid. It is further shown that the concept of vibratory and noise densification or compaction of stored bulk solids correspond to a decreasing entropy and the shift of distribution density towards the population of denser cells. Finally, a connection between the critical states reached in simple shearing of bulk solids and the loose random storing-state is established.

1. Introduction

Stored bulk solids form a geometrical probability space for the void space distribution which can be analyzed by statistical mechanical considerations and useful results and con- elusions may be obtained on their properties. As explained by Shahinpoor[1] there exists a close link between the random packing and storing of granular materials and bulk solids and the geometrical theory of the

structure of fluids. If the bulk solids are stored randomly there is a great tendency for the void spaces to form a uniform distribution and this essentially corresponds to a state of maximum configuration entropy. This randomly packed space will be unstable in the fields of vibration and shear and tends to density. The vibratory densification of stored bulk solids forces the uniform void space distribution to become skewed towards the population of smaller void spaces. We shall elaborate on the above concepts in the present paper and introduce the notion of a critical state for a stored bulk solid. The physical correctness...