

## BOOK REVIEW

**Advances in the Mechanics and the Flow of Granular Materials Vols I & II** (edited by M. Shahinpoor, pp. 975), Trans Tech Publication, Germany

When glancing through the pages of the two volumes of *Advances in the Mechanics and the Flow of Granular Materials*, one discovers a highly diversified and intriguing content. There are many conference proceedings and special volumes devoted to the mechanics of granular media; however, this one is unique. It combines topics seemingly unrelated, such as the mathematical description of the geometry of a single particle and the occurrence of the divisions in Saturn's rings. Perhaps the logo on the covers explains the content better than the title.

The editor of these volumes, Dr M. Shahinpoor, has to be credited for inviting contributors from different fields of what one might call the science of granular assemblies. With this understanding, it is not surprising that topological, mechanical, electrical and transport properties or phenomena in granular assemblies are presented in one book. The authors of the 46 papers come from many countries, with a significant proportion from non-English-speaking regions, thus providing a reader with results that otherwise could be difficult to access. This is reflected in references to some of the papers, which contain sources that are predominantly from the native country. In many cases, the contributions are masterly prepared for the volume; they encompass results obtained over a long period of time. It is not a collection of papers describing particular solutions or narrow problems. In this respect, the authors should be highly regarded for their thorough, up-to-date treatment of topics.

The material is arranged into six chapters, which have titles well explaining their content: 1. Random Packing of Granular Materials, 2. General Morphological Characterization and Measurements, 3. Statistical Mechanical Considerations, 4. Electrical, Thermal and General Transport Properties, 5. Granular Materials Rapid Flow, General Dynamics and Fluidization, 6. Granular Materials and Soil Mechanics. The articles deal primarily with analytical and to some extent with numerical modeling of the arrangement of granular assemblies and the various physical phenomena associated. The results may apply equally to liquids and to assemblies traditionally regarded as solids. Less attention is focused on applications and, with a few good exceptions, on experimental verification. The approach adopted in most papers reflects a current trend in deriving the governing equations from microscopic and statistical points of view. This approach has proved to be successful in chemical or material engineering, where transport phenomena are of primary interest. Here, the geometrical and physical properties of the material are usually well defined; assembly is often initially uniform and isotropic, and the boundary value problems are relatively simple. In civil and geo-engineering, a macroscopic approach is overwhelmingly preferred, though recent developments, including those presented in the volume, utilizing microscopic considerations have brought significant results. Perhaps the diversity of the natural deposits of granular media, their unknown properties and the complexity of the boundary value problems discourage, unfortunately, wider attempts in the latter approach. However, a simple macroscopic modeling allows for thorough investigation of general formulation problems, such as existence, uniqueness, stability and boundness of the solution. Useful, analytical results have been obtained, giving a reference for numerical methods. The storage

and the flow of bulk materials in containers and transporting ducts partially overlap both chemical and civil engineering interests. Fluid mechanics and solid mechanics modeling have found fruitful application, depending on the rate of flow. The former approach is well represented in the volume.

The intent of publishing the book was “to provide a foundation for bridging the gaps” in the mechanics of granular media. Although not yet completed, a foundation or rather a cornerstone has been laid, and Dr Shahinpoor has to be congratulated for this.

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