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STRUCTURAL CHARACTERIZATION OF POROUS AND GRANULAR MATERIALS

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Summary. The morphological details of permeable porous materials have a significant impact on their physical macro-scale properties and on their transport properties in particular. A systematic method has been previously suggested [1-3] to derive relations between structural characteristics on the pore-scale and macroscopic properties. We present here the first steps towards examining the method on numerically produced systems.

A significant ingredient of the method is a mathematical characterization of the local structure by a tensor that targets the structural properties most relevant to a large number of physical transport mechanisms. The tensor is an outer product of vectors that comprise dual networks that describe the system connectivity. The locality of the tensorial description is achieved by defining specialized volume elements, called quadrons. The description is then used in an entropy-based statistical formalism, where the quadrons play the role of quasi-particles. The formalism allows us to derive structural properties as expectation values over a particular partition function. These structural properties are then related to physical properties, such as permeability and heat transfer.

The current work focuses on testing the initial stages of the method on numerically generated two-dimensional granular packs. Results related to the statistics of the quadrons and the structural tensor are presented.

References

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