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Modeling, Estimation, and Control Related Issues in Physical and Biological Applications

**A Quasi-variational inequality with gradient constraints approach to the  
growth of sandpiles and related processes**

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**Abstract:** We consider the modeling, approximation and computational implementation of the growth of large sandpiles and related monotone processes with pointwise constraints on the gradient. The evolutionary problem is formulated as a quasi-variational inequality and an approximation procedure is introduced. The regularity and several qualitative properties of the solution are studied, and convergence of a proposed algorithm is determined. Numerical tests using semismooth Newton methods, for problems with and without diffusivity, and with diverse nonlinear constraints are provided.