A robust computational approach for dry powders under quasi-static and transient impact loadings

Tobias Erhart, Wolfgang A. Wall, Ekkhard Ramm

Abstract:

Powders are challenging materials for many engineers and scientists, since they often show unexpected behavior which is quite different from the behavior of gases, liquids or solids. In addition, powder-like materials appear quite often in real applications. Our study is driven by the need to appropriately grasp the behavior of dry powder and our main focus is on the damping and energy absorbing behavior of dry powder under impact loading. The overall approach, including both the model and the algorithmic setup, that we developed for this purpose is presented in this paper. Applicability to quasi-static as well as highly transient real world problems and robustness are crucial constraints for the whole undertaking. These requirements are met through a model with relatively few and, more importantly, easy-to-obtain material parameters and through some special algorithmic developments. After a general introduction into powder, our continuum model based on finite strain elasto-plasticity for the simulation of quasi-static and transient dynamic processes is presented. Then the algorithmic setup, i.e. the required return mapping...
algorithm formulated in principal stresses, is presented. Finally, the parameter determination from standard laboratory tests is described and appropriate numerical results are shown for both quasi-static and highly transient impact cases.

Stichworte:
principal stress, test standard, standard test, return mapping, algorithmics, modeling, quasi static theory, vibration, elastoplasticity, inelasticity, high strain, energy absorption, powder, mechanical shock, transient response, static load

Dewey Dezimalklassifikation neu:
620 Ingenieurwissenschaften

Zeitschriftentitel:
Computer Methods in Applied Mechanics and Engineering

Jahr:
2005

Band:
194

Heft / Issue:
39-41

Seiten:
4115-4134

Reviewed:
ja

Sprache:
en

Volltext / DOI:
doi:10.1016/j.cma.2004.10.007

Status:
Verlagsversion / published

Semester (für SAP-Datenerfassung):
SS 05

Format:
Text

Occurences:
· Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Werkstoffe und Verarbeitung > Lehrstuhl für Numerische Mechanik (Prof. Wall) > Peer-Reviewed Publications > 2005

Entries: